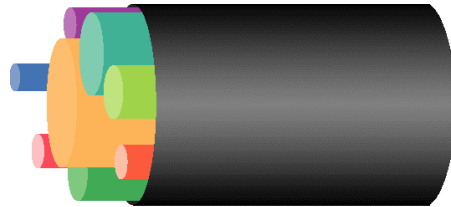


Packeteer Technical Product Overview

Innovative Bandwidth Farming For Providers of Managed Bandwidth Services



With Packeteer's PacketShaper/ISP[®]

November 2001

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Innovative Bandwidth Farming

Network connectivity and availability are no longer enough — for subscribers or providers.

Internet Service Providers and Network Service Providers (hereafter simply called “providers”) must be sufficiently agile to create innovative services, offer tiered service levels, and control costs while increasing revenues. Quite a demanding charter.

Do any of these problems sound familiar?

- A few subscribers consistently exceed their contracted amounts of bandwidth, negatively impacting others.
- Your tiered service-level intentions don’t always match tiered service-level reality.
- A subscriber’s tenants complain they’re not getting enough individual bandwidth, even though the subscriber’s total bandwidth is correct.
- Subscribers complain about slow, stuttering multimedia performance.
- Although over-subscription without service degradation should be possible, it’s difficult to schedule and manage.

Packeteer’s PacketShaper/ISP product line is a bandwidth provisioning and management system that enables the delivery and performance of customized IP services. It gives providers the ability to deliver high-quality services, solve common bandwidth-farming issues like those listed above, and create compelling differentiated services.

PacketShaper/ISP enforces tiered service levels, allocates bandwidth minimums and maximums on a per-subscriber, per-user, per-application, or other basis, paces streaming media for optimum reception, and offers a variety of other features.

Subscribers of premium bandwidth services have premium expectations and require more than just a play-and-pray, best-effort attempt at quality. PacketShaper/ISP delivers on expectations.

With and Without PacketShaper/ISP

The power of PacketShaper/ISP is best illustrated by examining a week in the life of a provider that we’ll call BandInc.



BandInc had a dismal week. First, a large corporate subscriber cancelled — they claimed they didn’t get the bandwidth they were paying for. Then BandInc lost a sale to a prominent university because it couldn’t implement a capped, per-student bandwidth rate. Despite BandInc’s one equal (and inflexible) flat rate, some of its subscribers consistently commandeer more than their share of bandwidth, and others consistently lose out. And to top it all off, someone with a malicious sense of humor launched a DoS (Denial-of-Service) attack against BandInc’s network that flattened its 99.9 percent availability record.

Revisiting BandInc’s week, this time with PacketShaper/ISP deployed, creates a much more positive story:

- The large corporate subscriber does not cancel because PacketShaper/ISP ensures access to contracted bandwidth and then validates usage levels with a graph of the month's average and peak rates.
- BandInc gets that university sale because PacketShaper/ISP makes it easy to offer minimum and maximum user rates.
- Nobody suffers bandwidth inequities on top of flat-rate fees. PacketShaper/ISP offers BandInc the choice of allocation that is equal or explicitly, purposefully unequal. In addition, BandInc can integrate PacketShaper/ISP's variety of per-subscriber or per-user metrics with its billing system to enable differentiated billing.
- The DoS attack still arrives but has no negative impact. When PacketShaper/ISP detects a suspiciously high rate of new traffic flows being initiated from three outside clients, it restricts them to a lower rate. Because there is no traffic flood, there is no loss of service. BandInc retains its 99.9 percent availability record.

The remainder of this paper delves into detail about PacketShaper/ISP's features and their value to you, a provider of managed bandwidth services. Most discussion deals with features and usage scenarios for application-agnostic bandwidth services. But there are also comments about network traffic from specific applications for those who offer a few application-aware services.

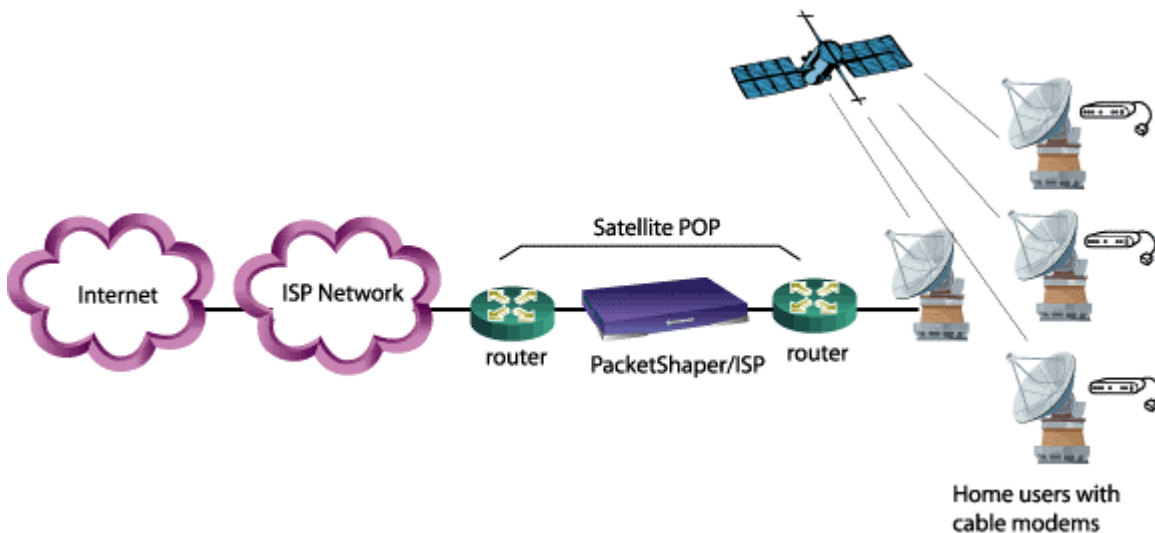
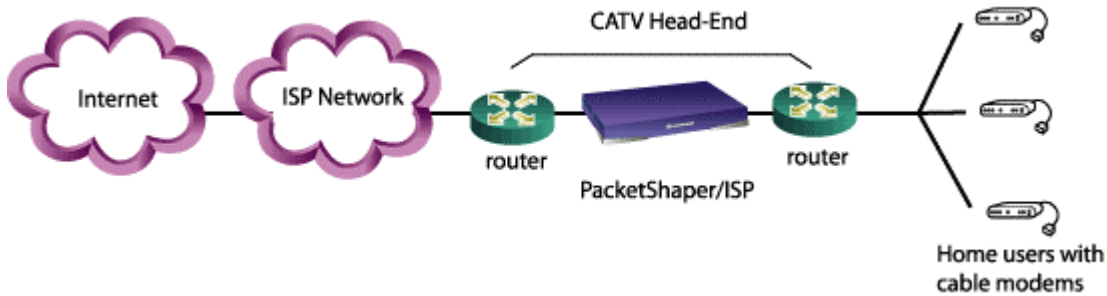
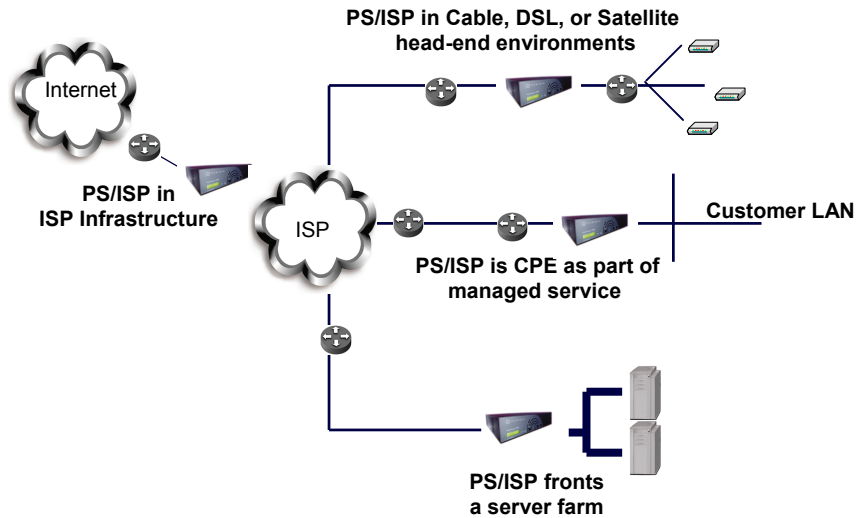
Keep in mind that PacketShaper/ISP's features are not only powerful but flexible. You can decide which features to use and the level of complexity you want. Although this paper delves into a lot of detail and options, you need not feel compelled to take that route. You can start simply and implement more intricate strategies later if required.



Deploying PacketShaper/ISP

PacketShaper/ISP is a bandwidth-provisioning appliance that sits between a WAN-link router and a LAN. It manages all inbound and outbound traffic, categorizing and analyzing the packets and then allocating bandwidth appropriately with policy-based criteria.

PacketShaper/ISP provides benefits to a variety of environments: cable, fixed wireless, satellite, a range of WAN and LAN speeds, and server- or edge-located bandwidth services. PacketShaper/ISP even fits smoothly in provider networks with multiple VLANs, whether to separate each subscriber's traffic or the provider's administrative traffic. Some example topologies include:



PacketShaper/ISP installation consists of plugging in two cables and entering IP address and access information on a web-based setup page. PacketShaper/ISP integrates cleanly with existing network infrastructure, imposing no changes on router configuration, topologies, desktops, or servers. It also integrates smoothly with central, third-party management platforms and reporting tools such as HP OpenView[®], HP PolicyXpert[™], Micromuse NETCOOL[™], Concord eHealth, InfoVista[™], Microsoft Excel[®], and others. In addition, Packeteer's PolicyCenter[™] provides the convenience of centralized management to large deployments.

A web-based user interface offers access to PacketShaper/ISP from any desktop with a web browser. A command-line interface offers fast, detailed control from a Telnet session. You choose the level of security required to examine and alter PacketShaper/ISP's configuration and measurement data.

Categorizing Traffic

The first step in provisioning bandwidth services is to separate network traffic into categories. Why categorize traffic?



- To provide contracted service levels

Suppose you offer bronze, silver, and gold tiered service levels.

You can treat the traffic distinctly only if you can distinguish one subscriber's traffic from another's.

- To separate subscriber usage information

Suppose a subscriber contracts for a 512 Kbps bandwidth rate. Only by separating and grouping all its traffic can you tell if it's getting the contracted amount or if it is a likely candidate for an upgrade.

- To enable differentiated billing models

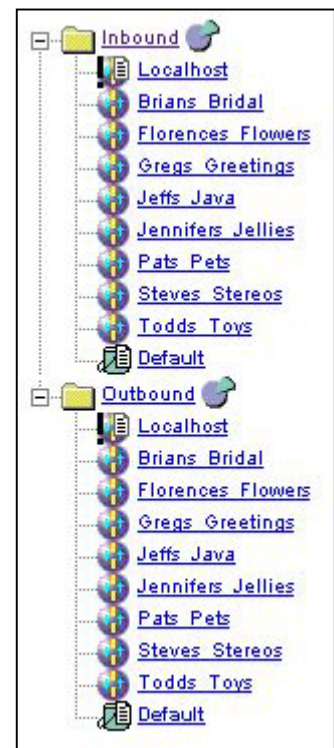
Consider how you might charge a small corporate subscriber with multiple employees if its usage varies tremendously from month to month. Per-subscriber usage metrics can be the foundation for variable billing.

- To distinguish each user

Imagine providing bandwidth services to a university that wants each dormitory room to have access to no more than 40 Kbps. Or perhaps you negotiate a contract where the first prescribed number of bytes per user are free, but generate charges thereafter. Per-user usage metrics are prerequisites.

- To separate one application's traffic from others'

Suppose you provide specialized bandwidth services that accommodate specific applications. Perhaps you provide the infrastructure for VoIP (Voice over IP) sessions or streaming media such as distance learning. These applications need customized treatment to ensure appropriate performance. To treat them distinctly, you need to be able to distinguish their traffic.



Rich classification sets the groundwork for everything else PacketShaper/ISP offers. After traffic is classified, PacketShaper/ISP can allocate bandwidth appropriately for the specific type of traffic.

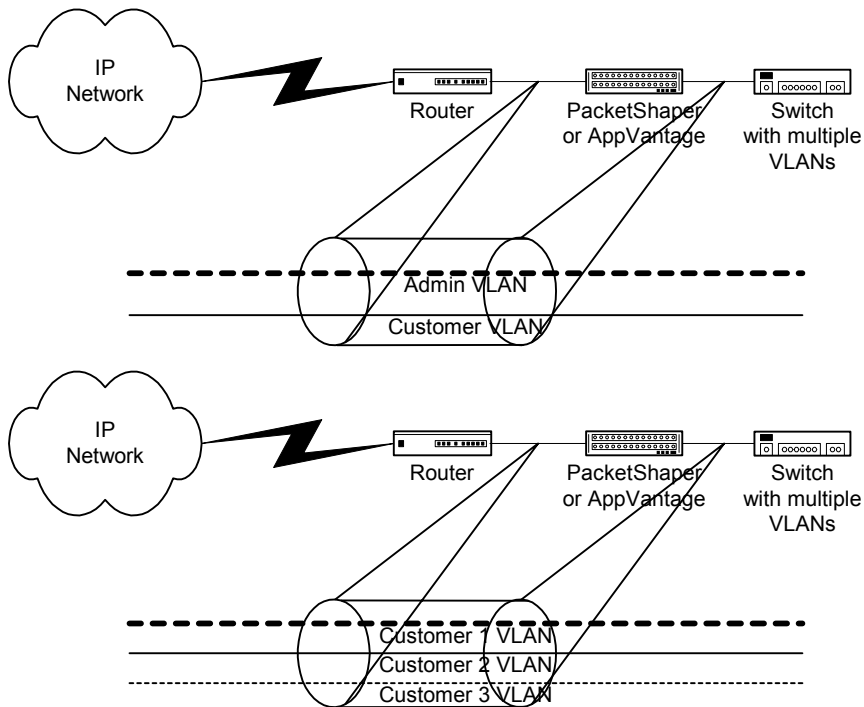
Keeping Subscribers Separate

PacketShaper/ISP can distinguish hundreds of different types of traffic. You can classify traffic by application, protocol, port number, URL or wildcard, host name, LDAP host lists, Diffserv setting, MPLS labels, IP precedence bits, IP or MAC address, subnet, travel direction (inbound/outbound), source, destination, host speed range, Mime type, web browser, Oracle database, Citrix published application, Citrix ICA priority tagging, ISL and 802.1p/q VLANs, and more.

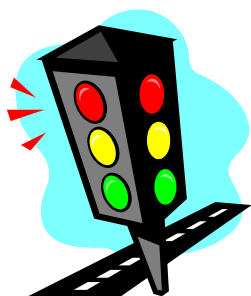
Each traffic category PacketShaper/ISP distinguishes is called a *traffic class*. PacketShaper/ISP builds a hierarchical traffic class tree, inserting an entry each time it detects traffic of a new category. Or you can create your own traffic classes manually.

Providers of managed bandwidth services are frequently interested in a classification scheme that separates each subscriber's traffic. The word "subscriber" in our context means one customer, independent of the fact that the one subscriber can have five or 5,000 individual users.

The popularity of VLANs has grown, as they require less administrative overhead and are less error-prone than maintaining host lists or using IP addresses. VLANs can be used to separate each subscriber's traffic and/or to separate a provider's own administrative traffic from subscribers' traffic. PacketShaper/ISP keeps subscribers' traffic separate whether you use subnets, IP addresses, host lists, or ISL and 802.1p/q VLANs as criteria.



Enforcing Effective Bandwidth Allocation



PacketShaper/ISP controls allocation on a per-subscriber, per-user, per-user-group, per-session, and/or per-service basis. As you'll see, this control translates into compelling and easy-to-administer bandwidth services.

Per-Subscriber Provisioning

PacketShaper/ISP's *partitions* enable you to create a virtual separate pipe for each subscriber (or other divisions of total bandwidth). Partitions function like frame-relay PVCs, but with the added important benefits that they cost less and share their unused excess bandwidth with other traffic. You specify the size of the reserved link, decide if it can grow (called *bursting*), and optionally cap its growth. In addition, you can embed partitions within one another (called *hierarchical partitions*) for finer control.



PARTITION

Name: /Inbound/HTTP

[← back](#) [update](#) [apply changes](#) [delete ...](#) [Go to Partition Summary](#)

Size: bps **Burstable** Limit: bps

Specify a "size" to reserve bandwidth for all traffic defined by the class and its non-partitioned children. The size can be zero. Set the "burstable" option to allow a partition to borrow available bandwidth from other partitions, up to the "limit" you define. If a limit is specified, it must be at least 1000.

With a partition, a subscriber always has access to its defined amount of bandwidth, no matter how active other subscribers are. If excess bandwidth is available, then the subscriber can have more bandwidth, up to its partition's cap. A partition does *not*, however, protect individual users or sessions from each other (that comes later).

Service Ideas:

- Reserve the contracted rate of 512 Kbps for a new subscriber without worrying that others will usurp it.
- For your smallest fee, do not allow a subscriber to consume more than its base amount — 512 Kbps, for example.
- For an upgrade fee, allow a subscriber to burst to more than its base amount when bandwidth is available — from 512 Kbps to 1 Mbps, for example.
- Increase the upgrade fee to raise the subscriber's base amount or its limit.
- Offer tiered service levels to subscribers. For example:
 - ✚ Bronze Plan: Outbound fixed size 64 Kbps; Inbound fixed size 64 Kbps
 - ✚ Silver Plan: Outbound fixed size 128 Kbps; Inbound fixed size 256 Kbps
 - ✚ Gold Plan: Outbound fixed size 128 Kbps; Inbound fixed size 768 Kbps
 - ✚ Gold Plus Plan: Outbound minimum size 384 Kbps and maximum size 512 Kbps; Inbound minimum size 1024 Kbps and maximum size 1.5 Mbps
 - ✚ Platinum Plan: Outbound minimum size 384 Kbps and maximum size 512 Kbps; Inbound minimum size 1.5 Mbps and maximum size 3 Mbps

- Limit obligations for promotional services

Perhaps you offer free or reduced-price services for select customers — schools or public libraries, for example. Although you want to continue providing these services, you don't want them to impact the bandwidth available to full-fee subscribers. By prioritizing access to excess bandwidth, you can give a public library some bandwidth but control its access to more bandwidth based on others' needs at the moment.

Per-User or Per-Group Provisioning

PacketShaper/ISP lets you control bandwidth allocation for each user or each group of users. These control features can be used in addition to the per-subscriber techniques (described previously) or alone.

Dynamic Partitions

PacketShaper/ISP's dynamic per-user subpartitions are an ideal solution for situations where a subscriber cares more about equitable bandwidth allocation than about how it's put to use.

Dynamic subpartitions are created on the fly as users initiate traffic of a given class. When the maximum number of

subpartitions is reached, an inactive slot (if there is one) is released for each new active user. Otherwise, you choose whether latecomers are refused or squeezed into an overflow area. Dynamic subpartitions greatly simplify administrative overhead and allow over-subscription. It's as easy to control 5,000 users as it is just one. As always, PacketShaper/ISP lends any unused bandwidth to others in need.

In addition, these same subpartitions can be created for a group of users within an IP address range.

Service Ideas:

- Offer a service for educational institutions where each dormitory student receives a minimum of 20 Kbps and a maximum of 60 Kbps to use in any way he/she wishes.
- Allocate equal bandwidth to each tenant in a shared facility. If there's lots of activity, they get smaller equal portions. If there's less activity, they get larger equal portions.
- Enforce a per-user contracted rate for wireless or cable. Cap each bronze user at 100 Kbps, each gold user at 150 Kbps, and each platinum user at 200 Kbps. Or implement any number of other schemes.
- Create a service where you protect and/or cap bandwidth for distinct departments within a company (accounting, human resources, marketing, and so on).

Per-Service/Per-Session Provisioning

Perhaps you are among the bandwidth service providers that have expanded their services to include a few application-focused bandwidth services.

For example, suppose you provide bandwidth to a corporate subscriber that also makes use of WebEx sessions (an online meeting facilitator) for distributed field meetings. You can offer a service that is tailored for the bandwidth needs of WebEx traffic, using PacketShaper/ISP to enforce appropriate bandwidth strategies and ensure WebEx performance.

Per-Session Control

When tailoring bandwidth allocation for a specific application-based service, PacketShaper/ISP *rate policies* are very useful, especially when combined with a partition, described earlier.

A rate policy limits or guarantees bandwidth to each individual session of a traffic class, keeping greedy traffic in line and protecting latency-sensitive applications. A policy controls the traffic for each session of each application separately, as opposed to controlling all traffic for all users together. You specify a minimum guaranteed rate and/or give the session prioritized access to more bandwidth, if available.

The screenshot shows the 'NEW POLICY' configuration window. The policy name is '/Inbound/HTTP'. There are buttons for 'back', 'add policy', and 'suggest policy'. The 'Type' is set to 'Rate'. A text box explains that the 'Guaranteed' rate is the minimum rate for each connection. Below this, there is a 'Guaranteed' input field followed by 'bps'. A section for 'Burstable at Priority' has a checkbox, a dropdown menu set to '3', and a 'Limit (optional)' input field followed by 'bps'. At the bottom, there are 'Options' buttons for 'scaling', 'admission control', 'diffserv', and 'failover'.

Service Ideas:

The following service ideas combine several bandwidth-allocation features:

- **Music Downloads**
Create a service to spot music downloads, contain them to 10 percent of a subscriber's network capacity, and prevent one high-capacity music lover from dominating all of it.
- **Voice Over IP**
Offer a VoIP package that reserves 20 percent of network capacity for all voice traffic, gives 21 Kbps to each VoIP session to avoid jitter and static, and redirects latecomers to a polite message during high-demand periods.
- **Streaming Media**
Create a service to ensure smooth performance for streaming media, allocating precisely the minimum bits-per-second rate required for good reception.
- **Games**
Offer to prevent games such as Unreal Tournament, Quake, Doom, and Diablo from taking any (or more than an approved amount) of a subscriber's bandwidth.

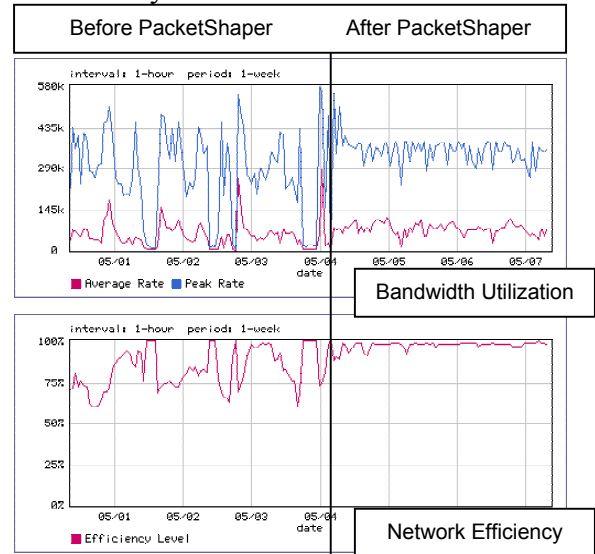
For Everyone — TCP Rate Control

Packeteer’s patented TCP Rate Control is a congestion-avoidance mechanism to ensure timely performance. It overcomes TCP’s shortcomings, proactively preventing congestion for both inbound and outbound traffic. TCP Rate Control tells the end stations to slow down — it’s no use sending packets any faster than they will be accepted once they arrive.

Rather than discarding packets from a congested queue, TCP Rate Control paces packets to prevent congestion. It forces a smooth, even flow rate that maximizes throughput. TCP Rate Control measures network latency, forecasts packet-arrival times, adjusts TCP window sizes accordingly, and meters acknowledgements to ensure just-in-time delivery of the transmissions.

Service Ideas:

Offer the benefits of TCP Rate Control in your standard service package as a competitive differentiator. Or, include it as an upgrade. Rate control is a broad service that improves overall throughput and reduces retransmissions.



Before-and-after graphs of throughput and efficiency like these can help sell a service.

Universal Translator

Packet marking is a growing trend to ensure speedy treatment across the WAN and across heterogeneous network devices. First, CoS/ToS (class and type of service bits) were incorporated into IP. Then, Diffserv became the newer marking protocol for uniform quality of service, essentially the same as ToS bits, just more of them. And more recently, MPLS has emerged as the newest standard, integrating the ability to specify a network path with class of service for consistent QoS.

PacketShaper/ISP can classify, mark, and remark traffic based on IP COS/TOS bits, Diffserv settings, and MPLS labels, allowing traffic types to have uniform end-to-end treatment by multi-vendor devices in heterogeneous WANs. In attending to marking and remarking, PacketShaper/ISP acts as a type of universal translator, detecting intentions in one protocol and perpetuating those intentions with a different protocol as it forwards the packets.

Partition and Policy Summary

Some of PacketShaper/ISP’s control mechanisms are summarized in the following table. The first three were explored in detail earlier in this section, and the last two are new. As you consult the chart, remember that a traffic class is all traffic associated with a subscriber, a user, a service, a service level, or any number of other criteria that are of use to you.

| Type | Description |
|---|---|
| Partition | Protect or cap all the traffic of one type or from one subscriber. You specify the size of the reserved virtual link and choose if it can exceed that size and by how much. |
| Dynamic Partition | Allocate a set amount of bandwidth dynamically, as needed, to each user or subnet within a traffic class. |
| Rate Policy | <p>Keep greedy traffic sessions in line or protect latency-sensitive sessions. Deliver a minimum rate for each individual session of traffic, allow that session prioritized access to excess bandwidth, and set a limit on the total bandwidth rate it can use.</p> <p>Smooth out spiky traffic using TCP Rate Control, Packeteer's congestion-avoidance mechanism that reduces queuing in router buffers and improves overall efficiency.</p> |
| Priority Policy | Establish a priority for the traffic in one class without specifying a particular transfer rate. |
| Discard and Never-Admit Policies | Block passage for all traffic in a class and optionally redirect web users to alternate URLs. |



Usage Analysis and Measurement

PacketShaper/ISP analyzes network traffic as it passes and stores relevant metrics for later use. You can import the metrics into third-party reporting or billing packages, or you can view them in a more intuitive format — PacketShaper/ISP's collection of graphs, tables, and reports.

Graphs and How They Help

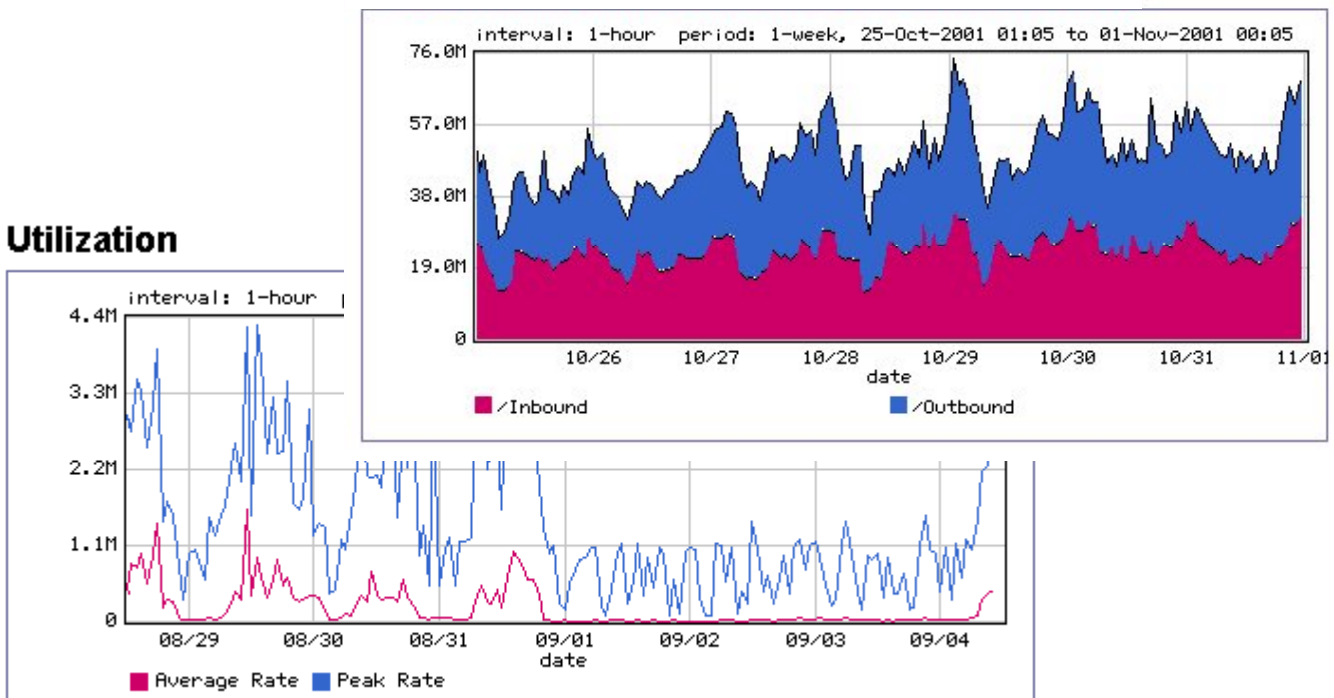
Once you make service-level commitments, validating service-level compliance becomes part of the contract. Promises are easy. But measuring actual delivered services is the only way to compare promises to reality. Provider-subscriber mediation is, in large part, based upon your ability to demonstrate you deliver on commitments.

PacketShaper/ISP tracks average and peak traffic levels, identifies top users and applications, and evaluates network efficiency. Graphs and statistics can help reassure subscribers that they're getting what they pay for as well as help you track your own progress and diagnose problems.

Validation

A graph of average rates over time shows subscribers their real picture. If a subscriber fears it is not getting what it's paying for, make sure they see their peak usage, not just average usage.

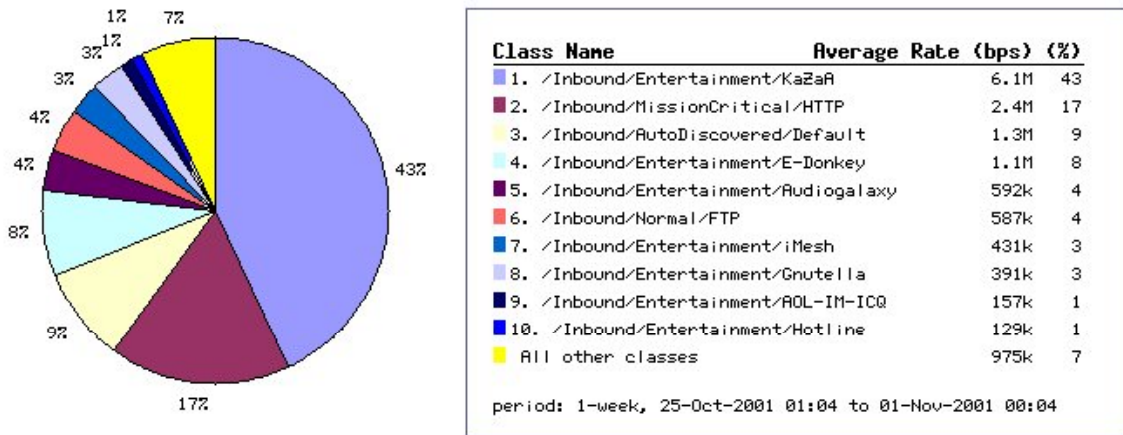
Utilization



The Tops

PacketShaper/ISP offers a variety of mechanisms to track top consumers of bandwidth. Results are displayed in lists, tables, pie charts, line graphs, and bar charts. You can even isolate and examine the top subscribers, services, users, web sites, groups of users, and other possibilities.

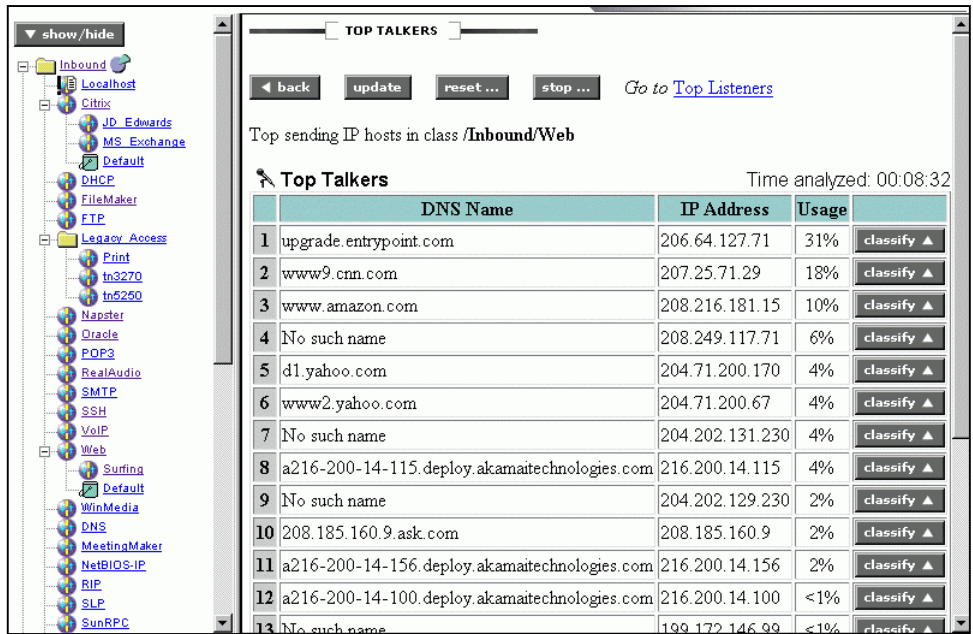
A pie chart gives an intuitive picture of your traffic classes that generate the most network traffic.



The Top 10 list ranks the top traffic classes with the percentage of bandwidth consumed for each.

| Outbound | | |
|--------------------------------------|-------------------|--------------------------|
| Outbound Link Utilization: 9% | Average Rate(bps) | Total Kbytes Sent: 58328 |
| Top Ten - Average Rate | | Top Ten Percent |
| Student/Default | 98.9k | 63% |
| Student/HTTP | 21.0k | 13% |
| Faculty/HTTP | 17.3k | 11% |
| Student/Multimedia | 5259 | 3% |
| Student/Student_IM | 5016 | 3% |
| FileSharing/Gnutella | 3049 | 2% |
| Student/SMTP | 2598 | 2% |
| Faculty/SMTP | 1406 | 1% |
| Faculty/Port_510 | 989 | 1% |
| Default | 585 | 0% |
| All other classes | 2100 | 1% |

PacketShaper/ISP generates lists, called Top Talkers and Top Listeners, of top recipients of (or top contributors to) any traffic class. You can use this feature to identify the top users within one subscriber, the most popular web destinations, and so on.

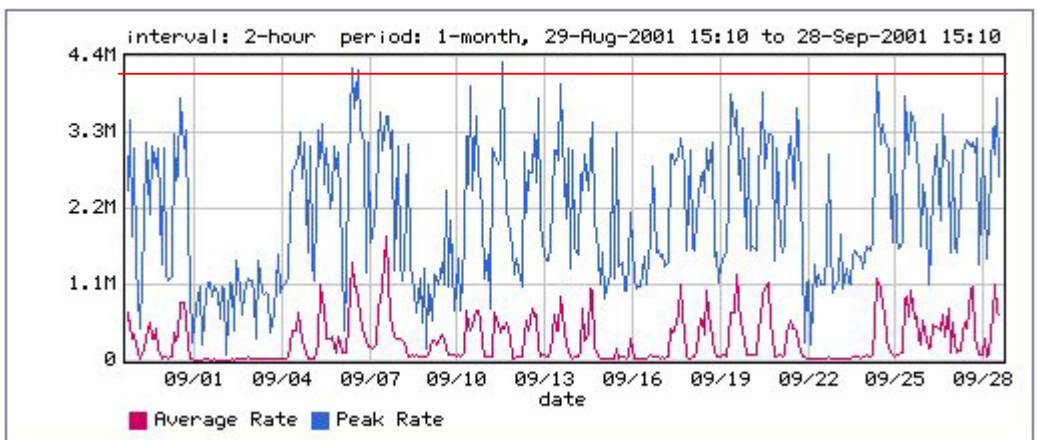


Another PacketShaper/ISP feature, called *host accounting*, tracks historical usage levels for each IP address and offers statistics summed for each user, host list, or subnet. If you import this data into a tool such as MS Excel, you can sort the results, yielding top users, or even a fully ranked list of users from top to bottom.

Sales Assistance

If a subscriber's utilization graph looks like the one below, suggest an upgrade! PacketShaper/ISP's Utilization graph plots the amount of bandwidth a subscriber purchases with the amount it actually uses. If its usage remains close to the purchased limit, it's time to sell a higher rate or more services.

Utilization



Capacity Planning

PacketShaper/ISP graphs can assist in spotting network load and trends.

For example, suppose a building manager wants to give each of 80 offices a set amount of bandwidth, say 50 Kbps. How many offices/users are active at one time? At peak times? Does this manager need to purchase (80 * 50 Kbps)? Is half that amount sufficient? How about two-thirds? A graph such as PacketShaper/ISP's Dynamic Partition Usage could answer these questions, showing the number of partitions in use at any given time.

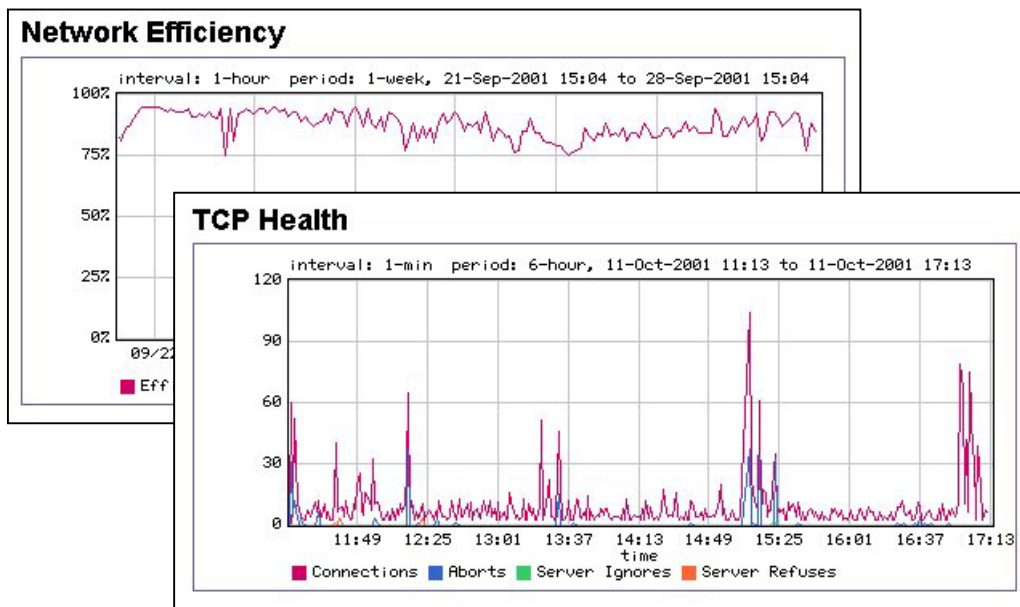
Dynamic Partition Usage



Diagnostic Aids

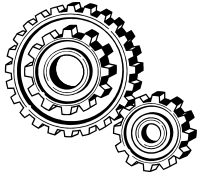
Some of PacketShaper/ISP's graphs aid the diagnostic process. Among them:

TCP Health provides a comprehensive picture of TCP connections for a link, partition, or traffic class. It compares the number of TCP connections that were started, aborted, and ignored/refused by the server.



Network Efficiency shows the percentage of bandwidth wasted by retransmissions. You can track the current retransmission rate or explore its history, focusing on a link as a whole, a subscriber, a subnet, a service, a web site, or other traffic of interest.

Raw Metrics



PacketShaper/ISP's rich set of metrics can be viewed via its own tables and graphs, or the data can be retrieved for use by other tools. Metrics can be extracted using a variety of APIs (application programming interfaces) or protocols and incorporated into databases and other reporting tools.

Administrators can extract data using HTML, XML, and CGI APIs, or the PacketShaper/ISP user interface. In addition, SNMP requests, SNMP traps, and POP3 email all work for gathering either synchronous or asynchronous data. Extracted data can be saved in a variety of formats, including SML, CSV, TSV, and ASCII.

PacketShaper/ISP's HTML and XML APIs provide database connectivity. Most modern database packages, such as Oracle and ODBC, provide data extraction agents based on these standards.

Third-party reporting packages such as Micromuse, standard web reporting tools, and the reporting functions within HP OpenView all generate reports based on PacketShaper/ISP data.

Some of PacketShaper/ISP's measurements that might be of interest to you include:

- Throughput in units of bytes, packets, transactions, connections
- Byte throughput for any traffic class: counts, averages, and peaks
- Throughput counts for any IP address, host list, subnet
- Counts and percentages of TCP connections that were denied by a policy, denied because of resource contention, ignored by servers, aborted by users, refused by servers
- Counts and percentages of TCP packets that were good, retransmitted, and tossed
- Number of HTTP response messages with 2xx success codes, 3xx redirection codes, 4xx client error codes, and 5xx server error codes
- Largest number of simultaneous TCP connections
- Number of users per dynamic partition, using dynamic partitions, and denied access to dynamic partitions
- Connection-speed histogram for profiling users



Customer Portal

In our web-based world, conveying information to subscribers is most conveniently accomplished through a web page. PacketShaper/ISP's Customer Portal is a web page that serves as a vehicle for delivering information about usage and status to a subscriber.

PacketShaper/ISP maintains the customer portal pages, updates their content, and makes them available to subscribers. You choose whether to use the portal as a competitive differentiator or as an add-on service for added revenue.

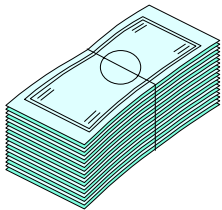
PacketShaper/ISP's Customer Portal offers subscribers customized, branded network and application status web pages, enabling subscribers to check their own status and reduce the volume of helpdesk calls.

The portal offers you the ability to:

- Generate metrics, graphs, tables, and reports that describe and validate usage
- Brand the look and feel of the web page for each subscriber or group
- Notify subscribers of service changes or other timely messages
- Keep subscribers informed and off the phone lines

PacketShaper/ISP maintains your portal's HTML pages and automatically customizes them for each subscriber. It serves HTML pages to subscribers when requested and insulates subscribers from each other's data.

Billing



PacketShaper/ISP metrics can be used with a variety of billing products on the market. Whether you choose a flat-rate billing structure or a variable, usage-based billing structure, PacketShaper/ISP helps you ensure your charges are fair and accurate.

Flat-Rate Billing

Many providers stay with a flat-rate billing structure because it's simpler and easier. If you use a flat-rate structure, perhaps you've noticed or suspected that some subscribers use much more bandwidth than they're paying for. With PacketShaper/ISP's precise, policy-based bandwidth allocation, you can enforce usage to conform to contracted limits.

Usage-Based Billing

Billing packages are only as effective as the data they receive. If you can only provide your billing software with per-seat/per-month statistics, that's the extent of your billing flexibility. With PacketShaper/ISP, you can provide usage and other metrics on a per-subscriber, per-user, or per-service basis.

PacketShaper/ISP's *host accounting* feature offers byte counts of throughput for each IP address, group of users in a host list, one or more traffic classes, or subnet. This is an important feature, as it enables:

- Departmental billing (Human Resources uses this much and Marketing uses that much)
- Quota-based billing (one price for up to one usage level, a higher price for more)
- Service-level-based billing (gold service pays more than silver for same usage)
- Flexible group billing (roll-ups of individual usage figures into grouped totals)
- Cut-offs (after a user exceeds prescribed bandwidth, access is cut)

Use PacketShaper/ISP's integration features to feed metrics to existing billing packages. Take advantage of PacketShaper/ISP's XML-based API or simply export comma-delimited data.

Once provider revenues are tied to results, subscriber trust increases along with subscriber retention. Subscribers will know that charges are calculated on more than intentions.

Detecting and Avoiding Attacks



Although PacketShaper/ISP is not a firewall, it can help detect and avoid DoS (denial of service) nightmares. Recent DoS attacks against popular web sites have raised concerns about vulnerability.

These insidious attacks wreak their havoc by employing a variety of mechanisms. For example, flood-type attacks initiate a large number of illegitimate connections that consume bandwidth and overwhelm receiving hosts.

PacketShaper/ISP has several methods to deal with the attacks. It can limit the number of connections to or from any host, the amount of ICMP traffic (a frequent attack vehicle that normally contributes just a small percentage of traffic), and the number of flows in one application or traffic class. It can also detect and block CodeRed, Nimda, similar worms, and traffic that is pretending to come from a trusted source.

Service Ideas:

Offer a service providing extra protection against DoS involvement.

- Limit the rate of new flows to or from a unique host.
- Place a limit on the number of concurrent flows for a traffic class.
- Limit ICMP to a maximum of 5 percent of the link size.
- Block traffic carrying the telltale signs of current worms.

Putting it All Together

To demonstrate how several PacketShaper/ISP features can combine to form a very effective bandwidth provisioning and management system, consider the following sample scenarios.

Scenario One – Service Levels and Individual Subscribers

Suppose you offer bandwidth services for email and for web access. You offer two service levels — *premium* and *standard*. Each subscriber is a single user. You’d like each user to have access to contracted amounts of bandwidth and no more. You’d like to have per-user usage data for billing. For your own purposes, you’d like to see more analysis data as well.

The following table lists the types of tasks for such a situation as well as the features for each.

| Task | Description | PacketShaper/ISP Features | | | | | | | | | | | | |
|------------------------------|--|---|---------|-------|-------|-----------------|---------|--------|---------|-----------------|---|-------|-------|---------------------------------|
| Organize subscribers | Create two LDAP host lists, one for each service level. Then, as each user subscribes to your services, add an entry to the appropriate host list. Alternatively, use separate VLANs to distinguish subscribers | Does not involve PacketShaper/ISP | | | | | | | | | | | | |
| Organize traffic | Expand your Inbound and Outbound traffic trees to look like: <ul style="list-style-type: none"> - Premium <ul style="list-style-type: none"> - Web - Email - Standard <ul style="list-style-type: none"> - Web - Email | Traffic class definitions (for Premium and Standard, and then Web and Email under each) Automatic traffic discovery and classification Layer-7 application identification | | | | | | | | | | | | |
| Provision bandwidth | Give each active premium user a private partition of 80 Kbps, and each active standard user a private partition of 40 Kbps (or whatever your service includes). | Two dynamic partition definitions | | | | | | | | | | | | |
| Assess per-user usage | Retrieve per-user byte counts for web, for email, and total. Examine figures for last month, two weeks ago, or other defined intervals. Example: <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>IP adr or DNS name</th> <th>web</th> <th>email</th> <th>total</th> </tr> </thead> <tbody> <tr> <td>192.123.123.123</td> <td>1593849</td> <td>341638</td> <td>1935487</td> </tr> <tr> <td>192.321.321.321</td> <td>0</td> <td>25412</td> <td>25412</td> </tr> </tbody> </table> | IP adr or DNS name | web | email | total | 192.123.123.123 | 1593849 | 341638 | 1935487 | 192.321.321.321 | 0 | 25412 | 25412 | Host accounting with categories |
| IP adr or DNS name | web | email | total | | | | | | | | | | | |
| 192.123.123.123 | 1593849 | 341638 | 1935487 | | | | | | | | | | | |
| 192.321.321.321 | 0 | 25412 | 25412 | | | | | | | | | | | |
| Questions and Answers | <ol style="list-style-type: none"> 1. Who are the top Premium email users? 2. Which are the top web destinations accessed by Standard web users? 3. What is the state of TCP connection health? 4. What are the percentages of bandwidth going to web users? To email users? To premium users of either application? | <ol style="list-style-type: none"> 1. Top talkers, top listeners 2. Top talkers, top listeners 3. TCP health 4. Top-10 lists with bar graphs, top-10 pie charts | | | | | | | | | | | | |

Scenario Two – Subscriber Balance

Suppose you offer bandwidth services for large subscribers with many users. You'd like each subscriber to have access to contracted bandwidth, and some to have access to more, if available. One subscriber, a university, wants to give each dormitory student 40 Kbps and to protect bandwidth for the faculty and administration.

The following table lists the types of tasks for such a situation as well as the features for each.

| Task | Description | PacketShaper/ISP Features |
|---|---|--|
| Organize subscribers and their traffic | <p>Expand your Inbound and Outbound traffic classes, creating a traffic class for each subscriber.</p> <ul style="list-style-type: none"> - Acme - Banker Inc - Eastern Univ - Legal Inc | <p>Manual traffic class definitions (for each subscriber). Can be automated with PacketShaper/ISP's XML API</p> <p>Automatic traffic discovery and classification</p> |
| Refine university's traffic organization | <p>Subdivide the "Eastern Univ" traffic class into several subordinate classes:</p> <ul style="list-style-type: none"> - Eastern Univ <ul style="list-style-type: none"> - MusicFileSharing - Dorms - Faculty and so on <p>The MusicFileSharing class definition covers Aimster, AudioGalaxy, DirectConnect, eDonkey2000, Gnutella, Groove, Hotline, iMesh, KaZaA, Napster, Scour, Tripnosis, and many other popular vehicles.</p> | <p>Manual traffic class definitions (for each university category)</p> <p>Automatic traffic discovery and classification</p> <p>Layer-7 application identification</p> |
| Provision bandwidth | <p>Give each subscriber its contracted amount of total bandwidth in a distinct partition. If the subscriber paid for access to more, allow the partition to grow.</p> <p>Subdivide the university's partition into smaller, subordinate partitions for each class.</p> <p>Cap the MusicFileSharing class at 10 percent of the network (or any amount the subscriber is paying you to implement).</p> <p>Give each active dorm student a private partition of 40 Kbps.</p> | <p>Static partitions</p> <p>Static partitions, burstable with limits</p> <p>Hierarchical partitions</p> <p>Dynamic partitions</p> |
| Questions and Answers | <ol style="list-style-type: none"> 1. How close is each subscriber to using its max? 2. Which are the top users for each subscriber? And for last month? 3. How much bandwidth is wasted on retransmissions? 4. Which university users are the biggest music fans? 5. How is your bandwidth divided among subscribers? 6. What was each subscriber's average and peak utilization last month? 7. How can we let each subscriber see its own usage? | <ol style="list-style-type: none"> 1. Partition utilization graph/metrics 2. Top talkers, top listeners 3. Network efficiency 4. Host accounting or top Listeners 5. Top-10 pie charts, top-10 lists with bar graphs, or Monitor Traffic chart 6. Monitor screen Average and peak utilization graphs/metrics 7. Customer portal |

For More Information

PacketShaper/ISP enables you to create, manage, and provision innovative bandwidth services, paving the way for increased revenue, subscriber loyalty, and retention. If you would like more information, consult Packeteer's web site at www.packeteer.com or call 1-408-873-4400 or 1-800-697-2253.