

iboss Enhanced QoS & Bandwidth Shaping

iboss Security



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1 iboss Enhanced QoS and Bandwidth Shaping

1.1 Overview

The iboss enhanced QoS and bandwidth shaping engine allows dynamic stream based Internet bandwidth shaping that allows critical web traffic to flow even when an Internet link is at its saturation point. In addition, the enhanced QoS suite provides detailed reporting of configured bandwidth pools and traffic flows. With the iboss enhanced QoS and bandwidth shaping engine, network administrators can prioritize and manage bandwidth constraints with intelligent rules and network visibility.

The enhanced QoS suite is composed of two core components. The first is the configuration and policy component which is used to manage how bandwidth will be shaped. The second component is the reporting dashboard which provides the real-time visibility and reporting of the configured rules.

2 Configuring Bandwidth Policy

This section describes the policy and QoS configuration component of the enhanced bandwidth shaping engine. This is the first step in enabling and configuring the QoS engine.

2.1 Understanding how iboss bandwidth shaping works

The iboss utilizes intelligent bandwidth shaping in order to fully utilize and Internet bandwidth link. Unlike traditional QoS solutions which place maximum caps on particular types of traffic such as audio streaming, the iboss can be configured to dynamically lower bandwidth consumption by lower priority traffic such as audio streaming only when the Internet link is saturated and a high priority applications demand the bandwidth. Using this methodology, no bandwidth is wasted and the overall user experience is maximized as they are allowed to consume more low priority bandwidth when it is not being used for critical services on the network.

2.1.1 Bandwidth Pools

The iboss utilizes the concept of bandwidth pools. A bandwidth pool is an amount of Internet bandwidth that has specific types of traffic assigned to it. The amount of bandwidth in a pool is user configurable. The types of Internet traffic that share the pool of bandwidth are also user configurable and you can assign different types of traffic to the pool. For example, a pool of bandwidth can be created called "Audio/Video Streaming" with an allotment of 10 Mbps. Now different types of Internet traffic can be assigned to the pool such as the web category "Streaming Audio & Video" and the domain "youtube.com". There is no limit on the number of rules that you can assign to a bandwidth pool. Rules can be based on web category, IP Address, port number, or Internet domain.

Since each bandwidth pool is allocated a portion of the Internet bandwidth, the total sum of all bandwidth pools cannot exceed the total amount of Internet bandwidth on the network.

One key distinction is that any unused bandwidth from the pool will be distributed to the rest of the network and the other bandwidth pools. So, even though a bandwidth pool has 10 Mbps, it may actually consume more bandwidth if it is not being used by any of the other pools. This intelligent allocation of bandwidth allows for full utilization of the networks bandwidth without any waste.

2.1.2 Pool Bandwidth Maximums

Each pool is configured with two bandwidth maximums. Each maximum has a different effect on how the pool can utilize bandwidth. Below are the two maximums and their meaning:

1. Bandwidth During Saturation – This is the target bandwidth you would like the pool of bandwidth to receive when the Internet link is fully saturated or at its peak.
2. Bandwidth Hard Maximum – This is the maximum bandwidth the pool of bandwidth will ever be allowed to receive regardless of whether the link is saturated or not.

It is important to note that in most cases, the “Bandwidth Hard Maximum” is set to the total amount of the Internet link. What this does is allow the pool to consume unused bandwidth during non-peak times. Otherwise, if the pool had a maximum cap that was lower than the total available Internet bandwidth, any unused Internet bandwidth would be wasted even if the pool needed more bandwidth during non-peak times.

2.1.3 Overall Internet Bandwidth settings

In order to determine whether a pool of bandwidth should be allowed to use more bandwidth than has been allocated to it (“Bandwidth During Saturation” value), the QoS engine must determine if the Internet link is currently fully saturated. If the Internet link is not fully saturated and a bandwidth pool has a maximum that is set to the full Internet link bandwidth, the pool is allowed to consume more bandwidth. Otherwise, if the link is at saturation, the pool is pushed down to the “Bandwidth During Saturation” value in order to make room for other pools and bandwidth on the network.

Configuring the overall Internet bandwidth is the first step in configuring the iboss bandwidth engine. You must configure both the available upstream bandwidth and downstream bandwidth. If they are equal, they are set to the same value. You’ll want to set these values 2%-5% less than the total available bandwidth to the Internet. This is done to account for cases where your ISP is not providing the full bandwidth or there is some bandwidth loss due to the physical links. This way the bandwidth shaping can always begin shaping appropriately when bandwidth is at its maximum. For example, if you’re your downstream bandwidth to 100Mbps on a 100Mbps link but the theoretical 100Mbps cannot never be achieved due to either the ISP or Fast Ethernet connection, the bandwidth shaper would never start pushing bandwidth pools down during saturation because it will only do this when bandwidth hits 100Mbps. A good value for a 100Mbps link would be 97Mbps.

2.2 Working with the settings

To configure the iboss QoS, log into the iboss SWG, navigate to Controls->Bandwidth Shaping.

Figure 1 - Bandwidth Shaping/QoS Settings Page

2.2.1 Global Settings

The global settings affect the overall state of the bandwidth engine. Before enabling the engine via the “Enable” option, make sure to configure the appropriate “Total Downstream Bandwidth” and “Total Upstream Bandwidth” that matches the Internet link on the network. Set these values to about 3%-5% less than the theoretical maximum bandwidth for the network.

NOTE	The “Total Downstream Bandwidth” and “Total Upstream Bandwidth” is configured in kilobits per second (kbit/sec). To configure 100 Mbps, enter the value 100000 kbit/sec.
-------------	--

GLOBAL SETTINGS

[?]

Enable:	Yes ▾	
Logging Enabled:	No ▾	
Total Downstream Bandwidth:	95000	kbit/sec
Total Upstream Bandwidth:	95000	kbit/sec
Apply		

Figure 2 - Bandwidth Shaping Global Settings

The “Logging Enabled” option should normally be disabled during production. Having this enabled will log events any time a stream is shaped via the QoS engine. This can clutter the logs with superfluous events.

Below is a description of each setting:

Enable	This enables the bandwidth shaping engine. When this is disabled, all rules on this page are ignored and bandwidth shaping is completely disabled
Logging Enabled	Yes = Log an event when a stream is shaped. No = Disable logging when a stream is shaped. Should be set to “No” on a production network.
Total Downstream Bandwidth	The total amount of downstream bandwidth available to the network from the Internet. Set this value 3%-5% less than the theoretical maximum.
Total Upstream Bandwidth	The total amount of upstream bandwidth available to the network to the Internet. Set this value 3%-5% less than the theoretical maximum.

Figure 3 - Bandwidth/QoS Global Settings

2.2.2 Creating Rules and New Bandwidth Pools

Rules are created via the “Rule Detail” section. The rule detail section is shown below:

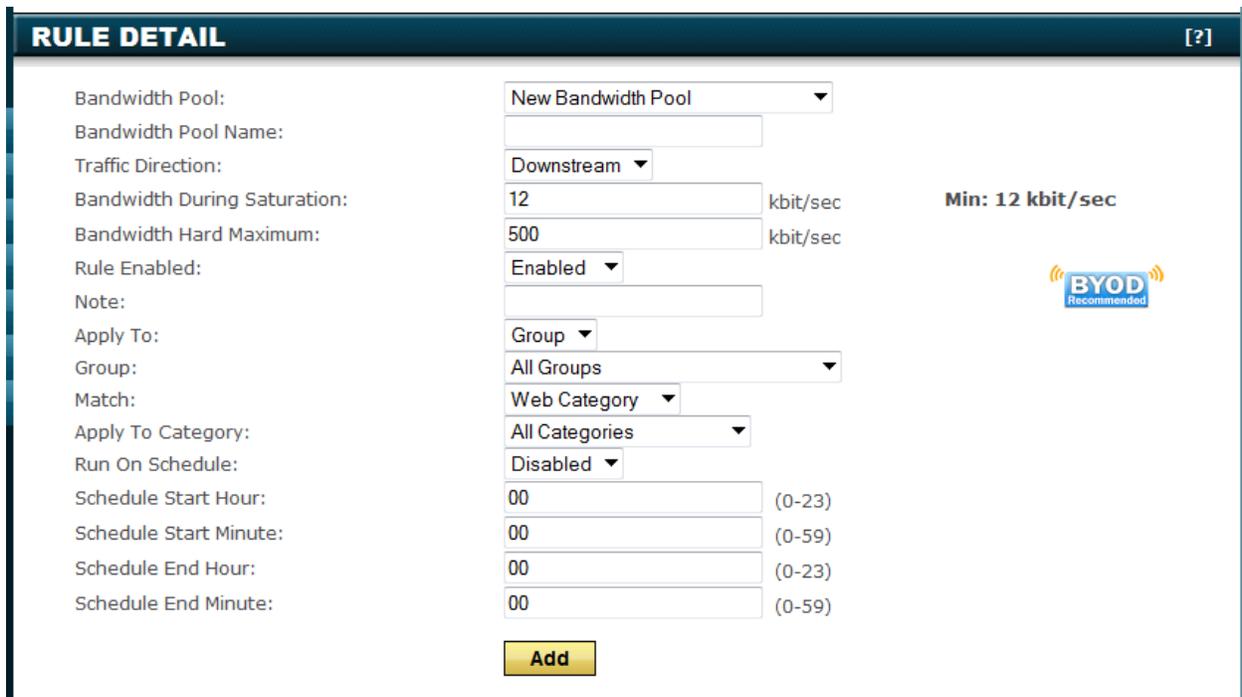


Figure 4 - Bandwidth Rule Creation

When creating rules, there are two primary choices:

1. Create a new bandwidth pool and assign the first rule to it
2. Create a rule and associate it with an existing bandwidth pool

Rules assign bandwidth streams to the pools. You cannot assign bandwidth streams to a pool if there are no pools present (no bandwidth pools are present when the very first rule is being created). The very first rule will both create the first bandwidth pool and an associate rule to assign bandwidth to it. When creating a new bandwidth pool you also must create the first rule that associates bandwidth to it which is done in the same step.

To create a new bandwidth pool, select “New Bandwidth Pool” for the option “Bandwidth Pool”. Then enter a name for the bandwidth pool. Enter a name that will allow you to recognize the pool later when you want to assign more rules to it. For example, good choices for a bandwidth pool name are “Critical Services” for representing streams that have high priority or “Streaming Audio/Video” for high bandwidth consumption streaming. The name is arbitrary and you can choose anything you feel is appropriate to describe the items that will be associated with the pool later. Remember, you can add as many rules to associate bandwidth to the pool any time in the future.

In addition, a few other options are required when creating a new bandwidth pool. They are listed below:

Traffic Direction	Downstream, Upstream, or Both. When downstream is selected, the pool is allocated from the total downstream bandwidth. When upstream is selected, the pool is allocated from the total upstream bandwidth. When both is selected, you are allowed to define the amount to be reserved from upstream and the amount that is to be reserved from the downstream total bandwidth.
Bandwidth During Saturation	How much bandwidth this pool should receive when bandwidth is saturated (at its peak).
Bandwidth Hard Maximum	How much bandwidth this pool is ever allowed to receive even when bandwidth is not saturated. Typically this is set to the total bandwidth since bandwidth should be used by this pool when it is available and not being used by other pools.

Figure 5 - New Bandwidth Pool Settings

When creating a new bandwidth pool, you also configure the first rule associated with it. This is done with the following options:

Rule Enabled	Indicates whether the rule is enabled or not. If the rule is enabled, the rule will not associate any traffic to the pool.
Note	Misc note for the rule
Apply To	Group or User. The rule can be applied to either a group or user. It is recommended that pools be assigned to groups to avoid over creating bandwidth pools. Target critical services and high consuming low priority bandwidth like streaming with just a few bandwidth pools.
Group/User	When "Apply To" is set to Group, you can assign the rule to "All Groups" or a specific Group. When "Apply To" is set to User, you can enter a username.
Match	Web Category, Domain, IP Address, Ports. A rule can match based on Internet web category (dynamically matching all streams through port 80 based on the category of traffic for example), domain (such as youtube.com), IP Address (cloud payroll system IP address, state testing IP Address range, etc), or Port (specific application port such as 3389 for Remote Desktop).
Run On Schedule	A rule can be set to run on a specific time schedule. Set to Disabled to disable scheduled rule matching and have the rule apply to all times.

Figure 6 - Bandwidth Rule Options

Click the "Add" button to add the new bandwidth pool and associated rule.

2.2.3 Adding additional rules to an existing bandwidth pool

Once a bandwidth pool is created, it will appear in the rule list toward the bottom of the page.

Rule #:	1	Parent Rule #:	1	Parent Rule
Pool Name:	Critical Services			
Note:	Payroll CRM Testing			
Priority:	1	Enabled:	Yes	
Apply To:	Group	Group:	All Groups	
Match:	Ip Address			
Ip Start:	216.115.208.0	Ip End:	216.115.223.255	
Direction:	Both			
Pool Bandwidth Down During Saturation:	85000 kbps			
Pool Hard Max Down Bandwidth:	95000 kbps			
Pool Bandwidth Up During Saturation:	85000 kbps			
Pool Hard Max Up Bandwidth:	95000 kbps			
Pool Current Rate:	2024bit UP/2160bit DOWN			
	Move To Priority Number	<input type="text"/>	Remove	Edit
		Move Up	Move Down	

Figure 7 - Bandwidth Pool Parent Rule

The figure above shows a parent bandwidth pool rule. This is something similar to what would appear after adding the first bandwidth shaping rule.

A parent rule is a rule which not only defines a bandwidth shaping rule, but also defines the bandwidth pool itself (for example, how much bandwidth the pool gets, the bandwidth pool name, etc). Additional rules can be added to the bandwidth pool by assigning the rule to an existing rule selecting the bandwidth pool for the "Bandwidth Pool" option when creating the rule. An example showing a rule being added to the "Critical Services" bandwidth pool in the above example is shown below:

RULE DETAIL [?]

Bandwidth Pool:	Critical Services (Rule # 1) ▼	
Traffic Direction:	Both	
Bandwidth Down During Saturation:	85000 kbit/sec	
Bandwidth Down Hard Maximum:	95000 kbit/sec	
Bandwidth Up During Saturation:	85000 kbit/sec	
Bandwidth Up Hard Maximum:	95000 kbit/sec	
Rule Enabled:	Enabled ▼	
Note:	Throttle during saturation	
Apply To:	Group ▼	
Group:	All Groups ▼	
Match:	Web Category ▼	
Apply To Category:	All Categories ▼	
Run On Schedule:	Disabled ▼	
Schedule Start Hour:	00	(0-23)
Schedule Start Minute:	00	(0-59)
Schedule End Hour:	00	(0-23)
Schedule End Minute:	00	(0-59)
Add		

Figure 8 - Adding additional rules to parent bandwidth pools

One thing to note from the example above is that when a rule is added to an existing bandwidth pool, the bandwidth direction and maximums cannot be adjusted. These are defined by the parent bandwidth pool when the bandwidth pool is created. To adjust these values, you must edit the rule that is marked "Parent Rule" which defines the bandwidth pool itself. When associating a "child rule", you are creating an association that places specific types of traffic into the bandwidth pool when it is detected going out to the Internet.

Repeat the process of adding rules to the bandwidth pools to associate traffic to the bandwidth pool. For example, you might create a rule that associates the domain youtube.com to a "Streaming" bandwidth pool and also create another rule that associates the "Streaming Audio/Video" web category to the "Streaming" bandwidth pool as well (Note, the "Streaming" bandwidth pool does not exist by default and was just chosen for this example).

2.2.4 Current Pool Bandwidth

The "Parent Rule" which defines the bandwidth pool also shows the current utilization of the pool. This can be used as a reference to see how much of the pool is currently being utilized.

However, for a detailed real-time view of all your bandwidth pools and bandwidth utilization, use the iboss Enterprise Reporter Bandwidth Dashboard. See Section 3 for working with the enhanced bandwidth reporting dashboard.

3 Advanced Bandwidth Reporting

The iboss Bandwidth Dashboard provides unparalleled insight to the state of bandwidth utilization on the network. The dashboard is used to both confirm the created rules are behaving as expected as well as determine the levels of each bandwidth pool and the overall bandwidth utilization on the network. This information can be used to adjust your bandwidth pools and determine when and how bandwidth is being used throughout the day.

The bandwidth dashboard is located in the iboss Enterprise Reporter. Log into the iboss Enterprise Reporter & Archiver, click on Real-time Dashboard, then click on the Bandwidth Shaping submenu.

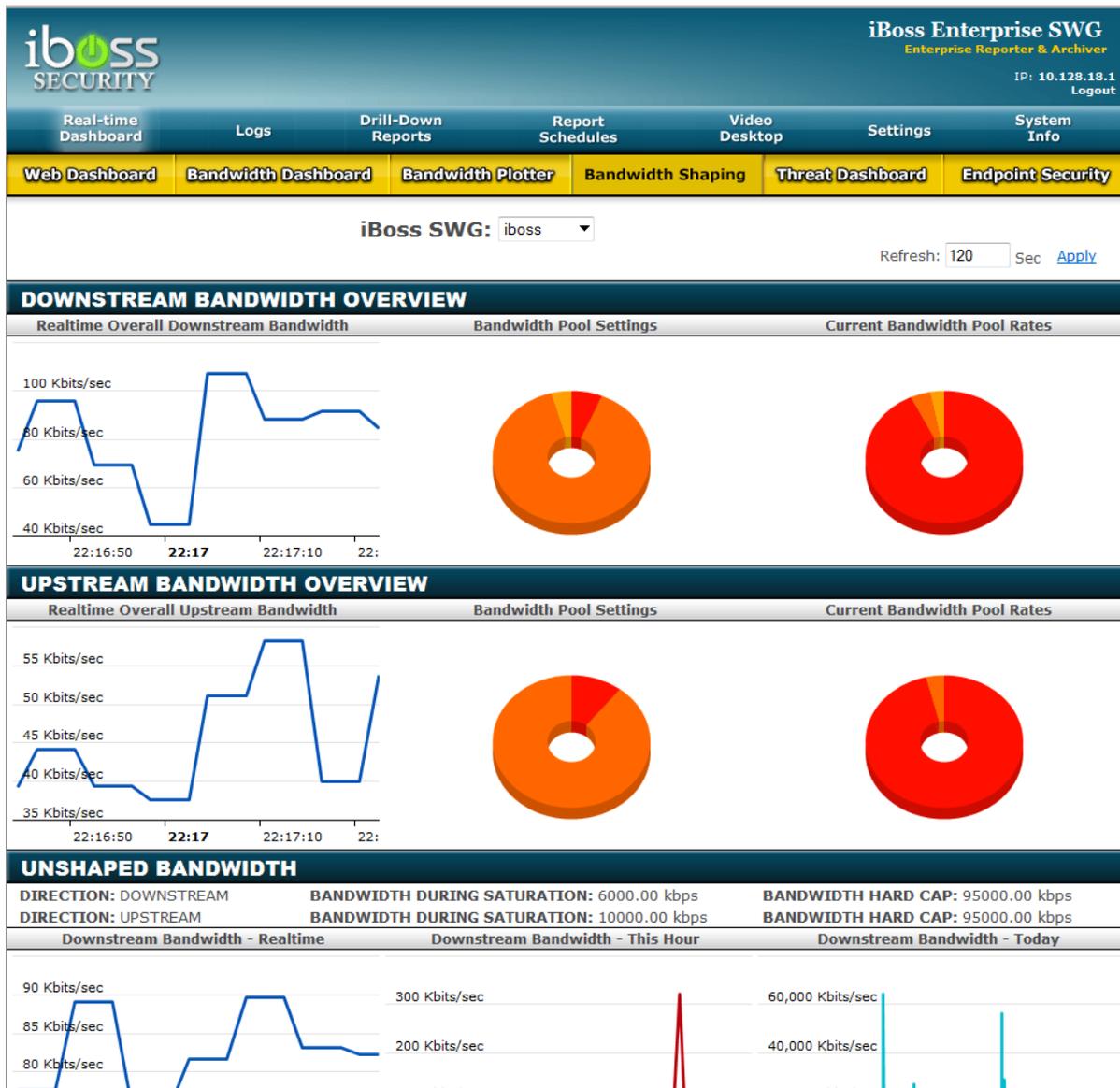


Figure 9 - Bandwidth Shaping Reporting Dashboard

The dashboard provides a multitude of information including your currently configured pool settings, the current rates to each pool, and real-time graphs of the utilization of each pool.

3.1 Downstream & Upstream Dashboard Overview

The first two section of the dashboard show the current downstream and upstream overall rates as well as configured pool settings.

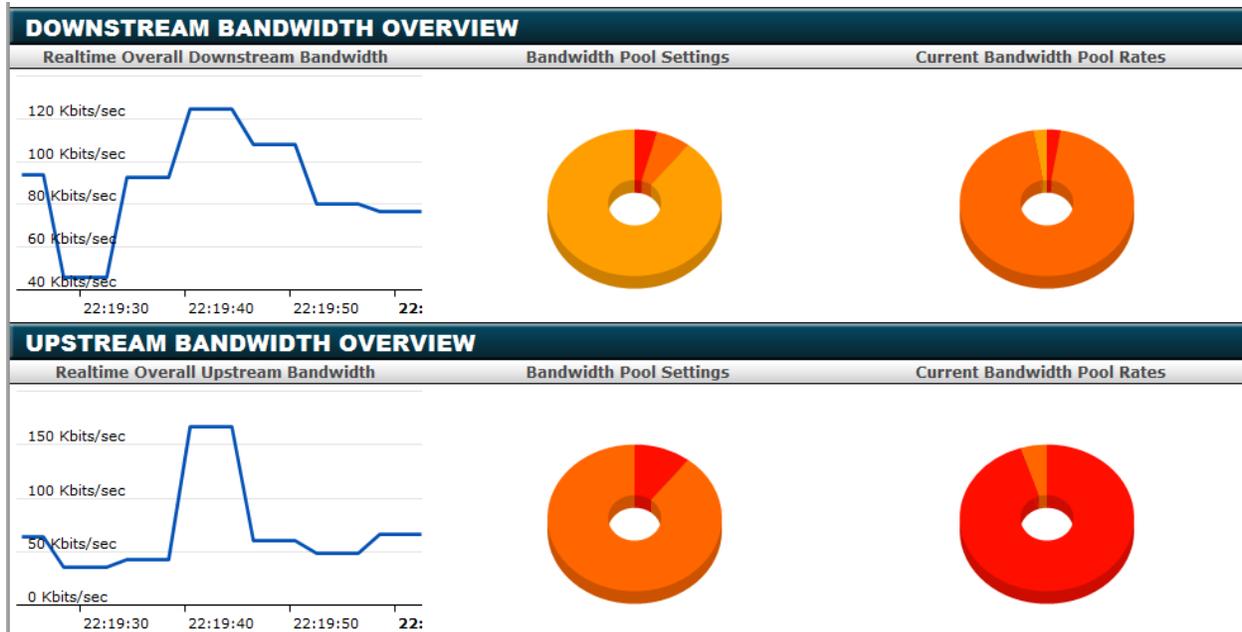


Figure 10 - Downstream & Upstream Real-time Overview

The first section “Downstream Bandwidth Overview” shows the overall state of the downstream bandwidth. The graph shows the current overall downstream (inbound) rate. The “Bandwidth Pool Settings” shows what you have configured for each pool as the target during saturation under the iboss SWG Bandwidth/QoS settings configuration section. The “Current Bandwidth Pool Rates” shows the current rate to each pool. Placing the mouse over any of the donut slices will show you the configured values. Remember that the current rate will only start to match the pool settings during saturation and depending on if the bandwidth causing saturation is coming from one of the configured pools.

There is a default built-in pool called “Unshaped Bandwidth”. This contains any traffic that does not match any of the bandwidth pools that have been configured. For example, if you have configured a “Critical Services” pool and also a “Streaming” pool, if Internet traffic does not match either, it will fall into the “Unshaped Bandwidth” pool.

The “Upstream Bandwidth Overview” is identical to the downstream section above, except it represents outbound (or upstream) bandwidth.

3.2 Real-time Bandwidth Pool Graphs

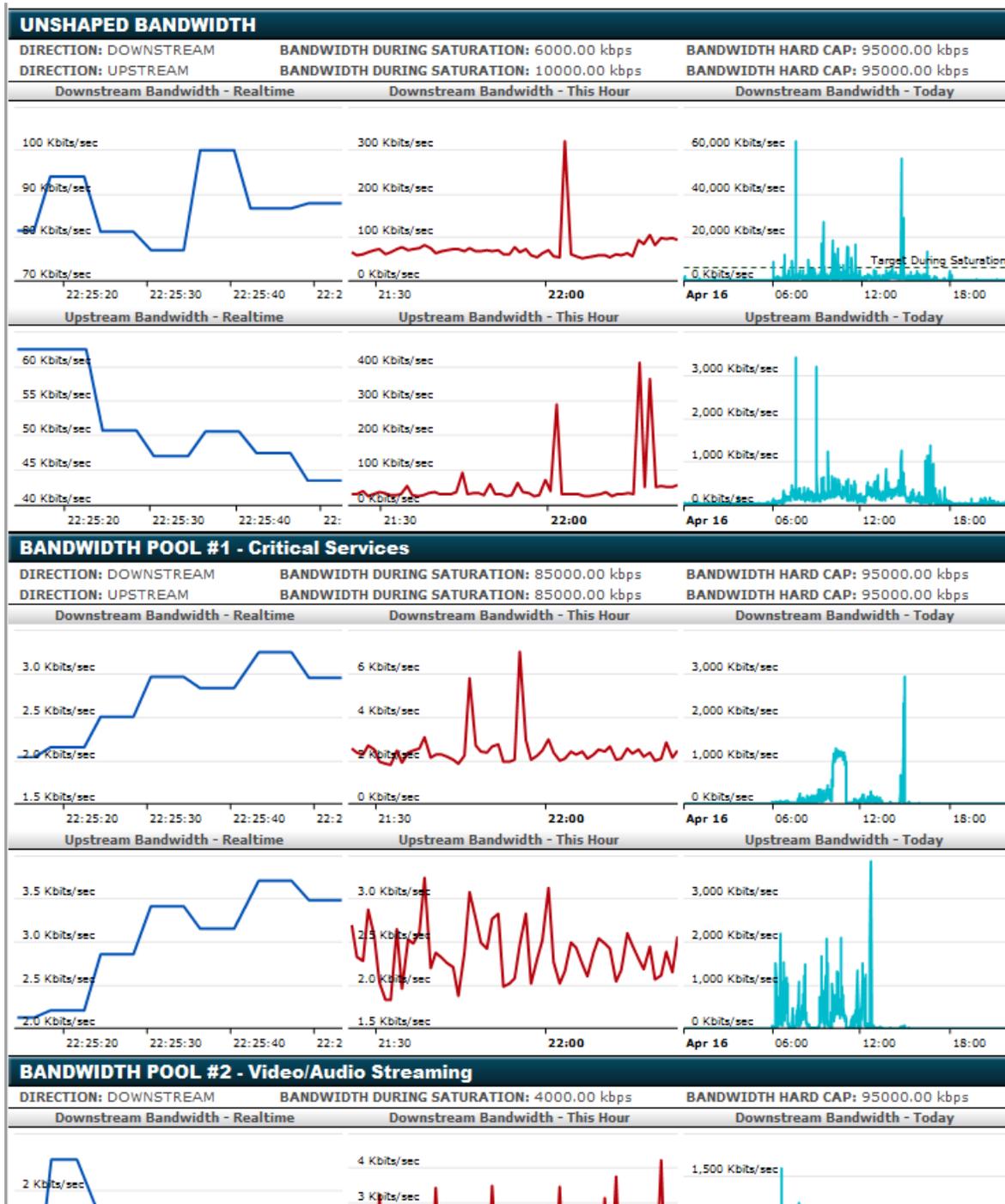


Figure 11 - Real-time Pool Bandwidth Graphs

The next section shows detailed information about the state of each bandwidth pool. If a bandwidth pool was configured to be applied to both upstream and downstream bandwidth (i.e. Direction = Both), the bandwidth pool will show two sets of graphs; one for the downstream bandwidth and the other for the upstream bandwidth. If the bandwidth pool was set to either downstream or upstream, a single set of graphs will be shown for the appropriate direction.

The graphs are very dynamic and show both the current state as well as an hourly and daily view of how the pool has been utilized. In addition, as the bandwidth reaches either a maximum cap or a target saturation point, the graph will display this information with a dashed line so you can see how the bandwidth is tracking the configured settings.

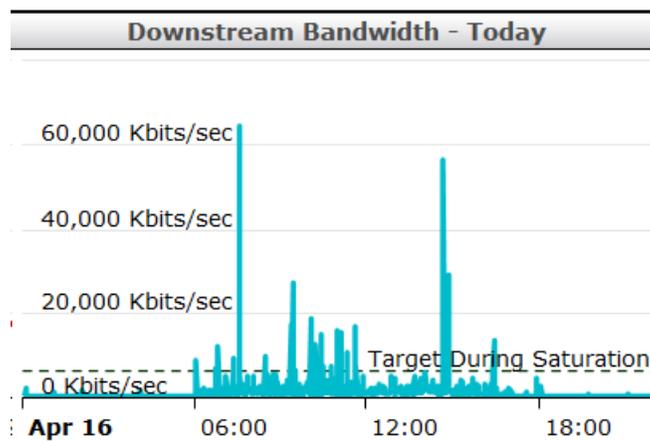


Figure 12 - Bandwidth Graph Showing Saturation Targets

Remember that a pool may exceed the set points if bandwidth is available. In addition, the iboss utilizes “burstable” bandwidth so that short bursts (such as a web page load which will consume a small spurt of bandwidth but then go idle) will load quickly. This allows bandwidth to go over the preconfigured maximums for short periods of time which is normal.

4 Special Considerations

There are some special considerations that should be noted when using the QoS engine.

4.1 Bypass IP Ranges

When adding an IP range to the iboss SWG bypass IP ranges (Network->Bypass IP Range), this affects how the bandwidth engine can classify traffic into pools.

The Bypass IP Range settings page is shown below:

Figure 13 - Bypass IP Ranges

Typically, if an IP address range is bypasses, it completely bypasses all signature engines (including QoS) in the iboss SWG. When adding the IP ranges, there are three options for the “Bypass Type” field that can be selected:

<p>Standard Bypass</p>	<p>The IP range is bypassed and no QoS matching is applied. Any bandwidth to or from the IP range will automatically fall into a default unshaped bandwidth pool and will not match any of the configured QoS rules.</p>
<p>Full Bypass</p>	<p>This is a full bypass of the IP range. The difference between this bypass and the “Standard Bypass” is that the “Standard Bypass” will still apply general iboss SWG rules such as DNS redirects. Even though the “Standard Bypass” will not perform any page block or application blocks, DNS requests may still be intercepted which allows you to add server ranges that contain DNS servers without affecting particular filtering rules which rely on DNS redirects. The full bypass completely excludes the IP range from DNS redirects.</p>
<p>Bypass But Apply Bandwidth Shaping/QoS</p>	<p>With this option, QoS rules are still applied even though the IP ranges will not be subject to blocking like above. DNS redirects are also still performed similar to the “Standard Bypass”. However, the QoS rule matching is limited to IP ranges and ports. Domains and Web Categories are not matched due to short circuiting of these processes in the iboss SWG.</p>

If you would like an IP range to still match IP and port based rules, make sure to add them with the “Bypass Type” set to “Bypass But Apply Bandwidth Shaping/QoS”. This allows servers to still be included for IP and port based QoS bandwidth pools.

4.2 Identified Computers

When a computer is identified on the Computers section of the iboss SWG with “No Filtering”, this affects how the QoS rules can be applied to that computer.

Figure 14 - Identified Computers Section

In the figure above, the computer “Bypassed Computer” is assigned a “No Filtering” group. Although this computer’s traffic will still be checked against the QoS bandwidth shaping rules, it will only match rules that are IP based or Port based. Rules that are based on a web category or domain will not be matched. This is because bypassed computers short circuit the filtering engine’s classification algorithms during the bypass. Since they still match IP and port ranges, servers can still get prioritized accesses to critical services such as a cloud payroll system or state testing site since those QoS rules will most likely be IP based to begin with.

5 Conclusion

The combination of intelligent bandwidth management and prioritization and unparalleled visibility allow for a whole new level of bandwidth control on your network. Not only can the enhanced QoS engine be used to manage bandwidth, the visibility it provides allows administrators the information they need to adjust and plan for future bandwidth requirements.

The iboss Enhanced QoS and Bandwidth management engine is one part of a suite of tools within the iboss SWG product line which allow you to obtain the next generation in visibility and control on your network.