Are you facing problems in handling any of the following situations?

- Unable to allocate bandwidth to the needy Users
- Unable to allocate bandwidth to user according to their needs
- Unable to control the heavy downloads of Music & Video files
- Facing reduced employee productivity problem due to chatting and web browsing not related to work
- Small number of users consuming majority of the bandwidth & robbing others
- Unable to put a check on non-work related traffic

If Yes, then you are not the only one, but sailing in the same boat of Network Managers across the world.

Above mentioned are few examples of the huge potential time waster for employees and bandwidth issues for the Network manager.

Cyberoam and Bandwidth

In the battle for Bandwidth on Internet access links, users consuming huge bandwidth for non-business related work can flood the capacity to the extent that the Business-Critical users cam remain completely undermined. Abundant data that swell to use any available bandwidth, network bottlenecks, and bandwidth hungry applications.... all seem to conspire against the network performance.

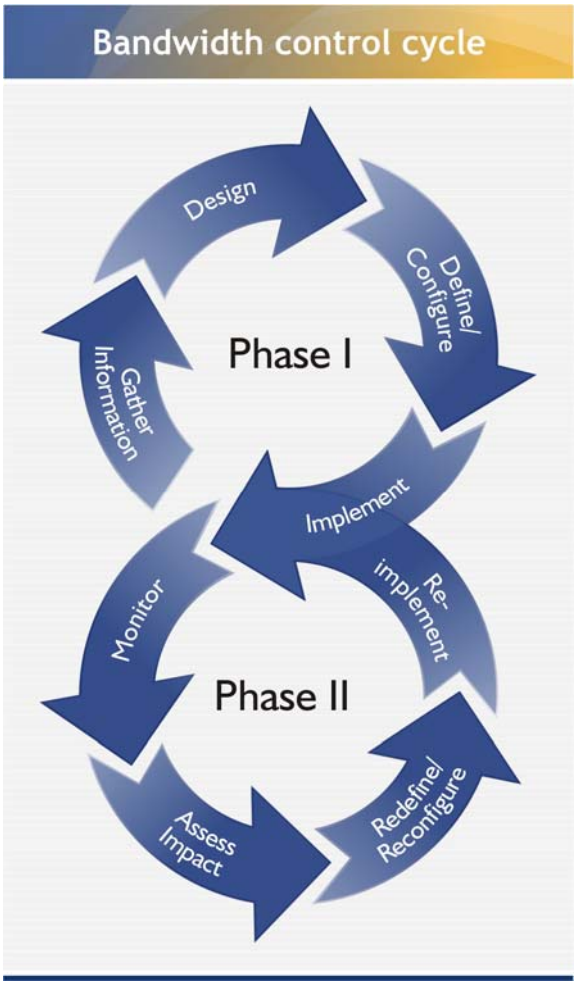
This whitepaper discusses how Cyberoam delivers centralized bandwidth control, optimizes Network performance and increases productivity for the 0rganizations.

Cyberoam Solution Components
• Allocate guaranteed bandwidth per user
• Automatically allocate the unutilized bandwidth (Burstable policy)
• Prioritize bandwidth to most essential or latency-sensitive traffic
• Schedule Internet Access based on time and day to control bandwidth
• Block streaming media files and recreational web surfing
• Limit upload and download
• Block virus signatures and patterns

Addressing the Problem

The very first solution for bandwidth unavailability is to "add more bandwidth". However, simply adding bandwidth does not solve the problem. Bandwidth Abusers will consume more if you add more and the problem remains. This leads to another solution "add more management". "Add more management" is a long-term strategy than simply "add more bandwidth".

Identifying the problem is the first step and finding the solution is another, but finding the solution is not enough. Cyberoam gives you the ability to implement "add more management" and helps solve the problem.



Cyberoam helps to evaluate the traffic and regulate its flow through the Network in accordance with pre-established management policies. The objective is to maximize the throughput and minimize the bandwidth wastage & un-utilization.

Various approaches to this type of Bandwidth management are articulated below that can be implemented with the help of Cyberoam.

Cyberoam Bandwidth management provides the method for observing data traffic flowing through the network, evaluating that data for potential network capacity concerns, and then making bandwidth throttling, priority, and traffic-filtering decisions based on a set of usage policies.

Cyberoam controls bandwidth allocation with a tremendous amount of flexibility and power and helps Network managers effectively manage, monitor and control the available bandwidth. Advantage is Cyberoam can provision bandwidth on per-user basis.

Each user maps to a bandwidth allocation policy which ensures an appropriate bandwidth slice and allows Business-Critical users higher priority and more bandwidth than the typical user.

Cyberoam Approach

- User-based Bandwidth Management

Corporate Networks must support myriad applications, but not all the applications have a direct relation with the business activities like:

- Business applications can also have non-critical aspects - Email, File transfers
- Frivolous applications can also have a business aspect – Chatting & Audio-visual presentations

In view of the above scenario, controlling only the Application access will not be sufficient; you need to control individual User's access to the Internet i.e. you need to place bandwidth limits as well as deny access based on content type.

E.g., you want to allow marketing group to view high bandwidth streaming media, but allow the Accounting group to view up to only 64k OR block MP3 files for everyone except Webmaster OR block MP3 files from being downloaded.

How?

Uncontrolled traffic consumes bandwidth in many different ways. To implement effective bandwidth management, one must first understand the behavior and bandwidth impact associated with Organization's common traffic types and how applying controls can affect performance.

- Identify User
- Identify traffic that will be generated
- Identify Content type
- Allocate/reserve bandwidth
- Deny/Allow access to Content type

If employees are waiting to download Excel or Visio files while the Webmaster tests his/her development Web content, frustration will be felt by all due to the slow-down in performance. Isolating the Webmaster from the rest of the staff can help better bandwidth utilization.

Because the control is placed on per-user basis, whenever the user requirement changes, only the User's policy needs to be changed. This also ensures consistent control on the User's access i.e. the access control is applied irrespective of the time and place from where user logs in.

Cyberoam - User Definition

Different Users have different needs for Internet access. You cannot control User access without knowing User's need and for this; you need to identify which User needs to access for what purpose and during which time slot of the day. Once you identify such Users, you can block access for the remaining Users.

For any Organization, one can divide Users into three types:

- Business-Critical users
- Business-Non-Critical Users
- Bandwidth Abusers

and they need to be prioritized and provisioned differently.

Cyberoam peeps into all the Web requests & responses, gathers the complete details on the transaction between User and Server, and produces report on Users and their bandwidth usage. These details can be utilized to identify Users and traffic generated by them.

How do you differentiate between the Users?

Cyberoam helps Network managers recognize and differentiate between the users by

- Monitoring the traffic on your Network
- Reporting traffic trends
- Keeping track of the Users who generate the most traffic
- Keeping track of Bandwidth consumption

The user information gathered by Cyberoam includes:

1. IP address, Time & day of the request & response
2. Web page category
3. File type
4. Content type
5. Complete URL
6. Bandwidth utilized
7. History of all the requests

Based on the information gathered, various policies can be defined.

Users

Business-Critical Users

- Generate highest level of business-critical traffic
- Need consistent and predictable bandwidth performance

They are the users who need bandwidth performance to do their job. Their work should not suffer because of unavailability of Bandwidth or the speed of Network.

Business-Non-Critical Users

- Generate business related traffic
- Need less consistent and predictable Bandwidth performance than Business-Critical Users

Their work will not suffer because of unavailability of Bandwidth or the speed of Network but need bandwidth.

Bandwidth Abusers

- Generate more non-business related traffic
- Need minimum bandwidth but actually, consume maximum bandwidth

Because of them, Business-Critical Users suffer as their applications take more time to process and have to wait, which leads to productivity loss, and finally the organization suffers.

Business-Critical users should get the highest priority while Bandwidth Abusers should get the lowest priority for bandwidth and Internet access.

Allocating Bandwidth

Once current and desired user Vs traffic behavior is understood, and business priorities are determined, bandwidth usage policies can be defined. Implement bandwidth management policies that prioritize, guarantee, and gauge bandwidth use, bringing enterprise traffic under control.

Cyberoam has gone beyond the common alternatives for bandwidth management and allocates bandwidth dynamically rather than statically. It ensures that every user and application receives guaranteed bandwidth while allowing to share the excessive bandwidth based on priority.

Committed bandwidth is the bandwidth that user will get every time i.e. guaranteed bandwidth

Burstable bandwidth is the maximum bandwidth that the user can draw, if available i.e. **Burstable bandwidth includes Guaranteed bandwidth**

Once the packet is accepted, the Cyberoam applies bandwidth policy which enforces bandwidth limits, and priority queue adjustment to assist packets in achieving the guaranteed rate.

If priority is configured, Cyberoam uses Hierarchical Token Bucket queuing discipline coupled with triple control as:

- Guaranteed bandwidth – minimum bandwidth reserved for user or application
- Burstable bandwidth – upper limit of the bandwidth that can be "borrowed" from the excess bandwidth.
- Priority – excess bandwidth priority. Eight priority levels are available, ranging from 0 (highest) to 7 (lowest)

As per the Hierarchical Token Bucket queuing discipline, packets will be dropped once the link bandwidth is exhausted. Further packets will be allowed only when the free bandwidth is available.

Example 1

Link/pipe capacity – 128 kbps
User A: Guaranteed bandwidth – 4 KB, Burstable bandwidth - 16 KB, Priority – 5
Application: Real media, Guaranteed bandwidth – 2 KB, Burstable bandwidth - 5 KB, Priority – 7
User B: Guaranteed bandwidth – 8 KB, Burstable bandwidth - 56 KB, Priority – 1
User C: Guaranteed bandwidth – 10 KB, Burstable bandwidth - 56 KB, Priority – 0

Assuming bandwidth is accessed in the below given sequence, Cyberoam will allocate bandwidth as mentioned in the below given table.

Calculation reference

Excess Pipe Bandwidth (1) = Excess Pipe Bandwidth (2) - Allocated Guaranteed bandwidth

Allocated Burstable bandwidth (if required) = User Burstable bandwidth (defined in policy) - Allocated Guaranteed bandwidth

Excess Pipe Bandwidth (2) = Excess Pipe Bandwidth (1) - Allocated Burstable bandwidth

User/ Application	Bandwidth required by User	Allocated Guaranteed bandwidth	Excess Pipe bandwidth (1)	Allocated Burstable bandwidth	Excess Pipe bandwidth (2)
-	-	-	128 KB	-	128 KB
User A	16 KB	4 KB	124 KB	12 KB	112 KB
Real media	5 KB	2 KB	110 KB	3 KB	107 KB
User B	56 KB	8 K	99 K	48 KB	51 KB

User C	56 KB	10 K	41 K	46 KB	0 KB
Final bandwidth allocation (Guaranteed + Burstable)	User A – 14 K (4 KB + 10 KB) Real Media application – 2 KB (2 KB + 0 KB) User B – 56 KB (8 KB + 48 KB) User C – 56 KB (10 K + 46 K) As priority of User C is highest, its requirement will be fulfilled by taking away 3 KB from Real media application and 2 KB from User A as they has the lowest priority If User D logs in after above bandwidth allocation, as pipe bandwidth is exhausted, packets will be dropped till any of the users free the bandwidth.				

Example 2

Link/pipe capacity – 128 kbps
1. User Based Shared Bandwidth policy – Guaranteed – 10 KB, Burstable - 25 KB, Priority – 3
User B, User C and User D share the policy.

2. User A: Guaranteed bandwidth – 25 KB, Burstable bandwidth - 56 KB, Priority – 0

When the shared bandwidth policy is applied, the guaranteed bandwidth is shared equally among all the shared policy users. Similarly burstable bandwidth if available will also be shared equally among all the shared policy users.

Total Bandwidth (for User) = Burstable bandwidth

Assuming bandwidth is accessed in the below given sequence, Cyberoam will allocate bandwidth as mentioned in the below given table.

Step	User	Bandwidth required by User	Allocated Guaranteed bandwidth	Allocated burstable bandwidth	Excess Pipe bandwidth
1	User B	10 KB	10 KB	0 KB	118 KB
2*	User C	15 KB	5 KB	10 KB	93 KB
	User B	10 KB	5 KB	5 KB	
3	User A	66 KB	25 KB	31 KB	37 KB
4+	User D	5 KB	3.3 KB	1.7 KB	12.1 KB
	User B	10 KB	3.3 KB	8.3 KB	
	User C	15 KB	3.3 KB	5 KB	

Note:

* As soon as User C logs in, guaranteed bandwidth of 10 KB is shared equally. Hence User B and User C both will get 5 KB each. But User C required total of 15 KB, hence it draws additional 10 KB from burstable bandwidth.

+As soon as User D logs in, guaranteed bandwidth of 10 KB is shared equally among User B, C and D i.e. 3.3 KB is allocated to each. Burstable bandwidth is also shared equally among User B, C and D i.e. 5 KB is allocated to each but as User D does not require 5 KB, remaining 3.3 KB (5 – 1.7) of the bandwidth is given to User B

As shared bandwidth policy is not applicable to User A, User A will be allocated the bandwidth as per his policy. User A requires 66 KB. Even though bandwidth is available and he has been assigned high priority, he will not be to use 66 KB because as per his policy he can draw only up-to 56 KB.

Bandwidth Management Challenges & Cyberoam Solutions

Challenge 1

Allocate required bandwidth to the Business-Critical Users every time

- Identify Business-Critical Users
- Make a Group of Business-Critical Users (if more than one)
- Define Committed Bandwidth Policy

This is the way you can ensure constant and required bandwidth to the Business-Critical Users and automatically allocate unutilized bandwidth

- Identify Bandwidth Abusers
- Make a Group
- Define Bandwidth Policy and allocate minimum bandwidth

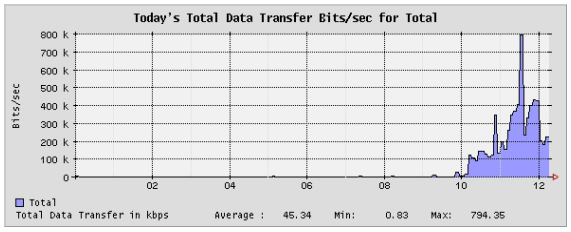
How it works:

One, it guards the Bandwidth need of Business-Critical Users by guaranteeing certain amount of bandwidth every time and two, it ensures Bandwidth Abusers get minimum bandwidth and cannot play with the bandwidth at the cost of work.

Challenge 2

Restrict Internet access and control bandwidth of the Users other than Business-Critical Users specifically during the Peak hours

- Check Data transfer trend
- Identify Peak hours for the Organization workload
- Determine maximum data transfer
- Identify Users other than Business-Critical Users performing maximum data transfer at peak hours
- Define Schedule of Bandwidth policy for the identified Users that restricts:
  1. Access within certain defined period only e.g. can access between 12 AM to 2 PM only and not throughout the day
  2. Bandwidth usage during that defined period



How it works:

One, it restricts other than Business-Critical Users from using maximum bandwidth during the peak hours and two, handles peak hour traffic load with improved response time

Above solution can also be used to:

- Schedule the bandwidth usage of Business-Non-Critical Users during any time of the day
- Restrict the bandwidth usage of Bandwidth Abusers

Challenge 3

Block non-business related traffic

Non-business related traffic can be defined as

- Non-business related contents like Advertisements, unwanted information
- Sites like Music, Chatting, Online Shopping & Gambling
- Any site or content, which consumes too much bandwidth

- Check the surfing trend like maximum non-business related sites surfed and data transfer
- Identify sites
- Identify Content types
- Identify file types
- Define Web category with site names, file types, keywords
- Define Security policy and attach Web category

Web category is the grouping of URL keywords for Internet site filtering.

Cyberoam allows to categorize Web sites such as Games, Music, Chat etc.. Once the web sites and contents are categorized, access to those sites and contents can be controlled through policies.

Depending on the organization requirement, allow or deny the access to the categories with the help of policies by groups, individual user, and time of day.

How it works:

Blocks non-work related contents that could reduce Employees productivity, network speed and consume unnecessary bandwidth.

Challenge 4

Configuring Bandwidth priority for latency-sensitive application

- Identify users
- Make Group (if more than one user)
- Define committed bandwidth policy and asssign highest priority
- Create user based firewall rule for the required application

How it works:

Cyberoam will provide bandwidth to low-priority applications only when bandwidth is not required by the high priority applications. For example, add bandwidth policy to guarantee bandwidth for voice and ecommerce traffic. Assign a highest priority to the policy that controls voice traffic and a medium priority to the policy that controls e-commerce traffic. Now when both voice and e-commerce traffic are competing for bandwidth, the higher priority voice traffic will be transmitted before the ecommerce traffic.

Impact of the Policies

How will you check whether the policy implemented is right and in tune with your requirements?

- Check Bandwidth utilization graph before & after the implementation of the Bandwidth policy
- Check User wise and Content wise Data transfer graphs
- Check User wise and Content wise Internet Usage graphs
- Check Web surfing graphs

Bandwidth utilization is directly related to the Network efficiency. Cyberoam provides the easy-to-understand & interpret graphs to check the bandwidth utilization.

Cyberoam provides bandwidth consumption history in bits-per-second. This answers the question "How much bandwidth does my traffic typically take?"

It also displays average & peak bandwidth consumption over a time. It also shows the amount of bandwidth not utilized or wasted. By checking the peaks, you can see if the traffic is frequently hitting a capacity limit and get an answer for the questions like:

- "Does the usage vary a lot?"
- "What are my average bandwidth needs?"
- "I have xxxx kbps bandwidth – is all that bandwidth really needed?
- "How frequently is my bandwidth insufficient?"
- "How much bandwidth remains unutilized most of the times?"

Conclusion

With the right policies in place, Organization saves cost by using unutilized bandwidth, increases Network efficiency and improves productivity.

An effective policy is the one that balances the need for information access, respect for privacy, and the mission requirements of the organization.

Reducing or eliminating non-business-related network traffic will mitigate the need to add network resources so that the Business-Critical Users are not impacted.

In addition, allowing only the content that cannot be considered threatening will reduce an organization's exposure to the growing attacks of Viruses. Lastly, an appropriate policy ensures that the internal network remains secure.