



# Bandwidth Management: New Use Cases

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*An AdvOSS Solution White Paper*

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## Introduction:

Recent years have seen explosive growth in the usage and deployment of converged services in telecommunication networks. These converged services include multi-media applications such as voice, video, text messaging, file transfers, chatting, online gaming to name a few. Most, if not all of these applications are bandwidth hungry in nature and require availability of sufficient bandwidth to be able to provide sustained service to the users. Devices have become smarter and more sophisticated, and are thus able to execute these high bandwidth applications much better than ever before. Since most of these applications are run inside the normal Internet browsing traffic, the Service Providers are mostly unaware of the discrimination inside the pipe. That is why they are known as the so called Over-The Top (OTT) applications since a Service Provider sees them as consuming more and more network resources; in our case, the resource in question is the bandwidth.

Service Providers and even vendors have jumped to the OTT bandwagon by offering their own OTT applications cheaply and quickly available to users via their application stores. As a result of this, bandwidth is becoming a somewhat scarce resource in many broadband access networks that operate on shared media e.g. WiMAX, Wi-fi, GSM, DSL and others.

However, as bandwidth is increasingly becoming a contended resource, it also opens up opportunities for Service Providers to offer premium services with higher Quality of Experience (QoE) for OTT and also for other specialized high Quality of Service (QoS) applications to subscribers who are willing to pay more for such QoE. Examples of high QoS apps include HD voice and video streaming etc. As a result we often see such service offerings for premium services and higher QoE from Service Providers worldwide.

Demand on the access side therefore, usually far exceeds the available throughput on the air interface as the subscriber base grows; a phenomenon that happens many a times on wired interfaces as well. Service Providers are implementing different ways to manage the bandwidth available to users so as to bring its utilization more in line with the business goals. Bandwidth management has thus become a key issue that needs to be handled. New generation AAA platforms, which are already burdened with providing several advanced features in the emerging telecommunication infrastructure, also have to play a key role in bandwidth control and management.

This white paper discusses some of the latest trends and techniques used for Bandwidth Management in the context of AAA servers. Typically these techniques apply to wireless links but are by and large applicable to wired broadband networks as well. In this paper we use the term Communication Service Provider (CSP) loosely in the sense that it covers both; network operators as well as providers of application and other services.

In the following sections, we provide critical business use cases and requirements that arise in bandwidth management and the role that AAA needs to play in that context.

## Bandwidth control based on periodically consumed data volume limits

Since bandwidth is a scarce resource in many networks, CSPs may want to control bandwidth of individual subscribers based on how much volume of data they consume within a given period of time. This period of time may be daily, weekly, bi-weekly, and monthly or based on subscription's period (billing cycle). A CSP may want to reduce bandwidth if the subscriber has exceeded the data volume usage beyond a threshold for that period. Example would be to reduce the bandwidth by 200Kbits/sec if the data volume has exceeded beyond 2Gbytes during a 24-hour period. The bandwidth is returned to the original subscribed value when the period has expired. To handle this use case, the following are the technical requirements for an advanced AAA solution.

### Technical requirements:

- Session Management and usage tracking
  - The network elements providing services have to supply the consumed data volume to the AAA server during an on-going user session. The AAA server needs to keep track of the consumed volume by adding up the usage volume numbers supplied to it by the network element and maintain that information in real-time user sessions. Therefore, session management with tracking of usage is a fundamental requirement of a modern AAA solution.
- Quota management
  - Bandwidth needs to be compared to the assigned quota and the time period of that quota in this module. If the bandwidth limit has reached within the given time period for the subscriber, the quota manager fires an event for the rest of the system announcing the expiry of quota for the subscriber.
- Policy management

On each Interim or authorization event, the AAA server queries the policy manager for any action related to a change in bandwidth driven by policy rules. accounting. If the policy manager replies with an action to update subscriber's bandwidth, the AAA carries out that action. A sophisticated policy manager with a rule based engine to specify policy rules on subscriber related data e.g. subscription details, profiles, bandwidth-quotas and other parameters related to service control, rating/charging etc. is an essential part of today's advanced AAA platforms.
- Change of Authorization (CoA)
  - Capability to update subscriber's bandwidth profile on the service delivery or enforcement point via Change of Authorization in RADIUS and other similar

techniques in Diameter is also an essential component of an advanced AAA solution. These are messages that are asynchronously generated by the AAA server and sent to the network elements, instructing them to update one or more subscriber's session parameters.

## Passing the benefit of additional bandwidth to all users when available in the network

There are always some hours of the day for a CSP when subscriber load and consequently bandwidth consumption is reduced. These are called off-peak hours. Examples may be at the start and end of the business day when people are traveling to and back to their homes, late night hours when most people are sleeping and so on. During these hours, bandwidth availability level becomes much higher in the network. CSPs are motivated to offer this available bandwidth as a benefit to the subscribers who are actively using the service during these hours. Bandwidth is added to the subscriber's session dynamically during these periods. The bandwidth is returned to the original subscribed value when the period has expired. To handle this use case, the following are the technical requirements for an advanced AAA solution.

### Technical Requirements:

- Policy management
- Change of Authorization (CoA)

## Passing the benefit of additional bandwidth to some users based on their subscriptions when available in the network

This use case is similar to the previous one with the only difference that the CSP may not want to offer the benefit of additional bandwidth availability to all customers. Instead, they may want to offer it to customers who subscribe to such a benefit by paying extra in the form of Add-Ons to the basic subscriptions. Therefore, we often see night unlimited packages or special off-peak rates etc. The bandwidth is dynamically added during higher availability periods to only those subscriber sessions who have bought these Add-Ons on top of their subscriptions.

To handle this use case, the following are the technical requirements for an advanced AAA solution.

### Technical requirements:

- Subscription and Add-on management in HSS

- HSS is the main data repository for storing subscriber credentials, subscription information and add-ons etc.
- Policy management
- Change of Authorization (CoA)

## Unlimited plans and Fair-Usage

Although, CSPs usually differentiate services based on available bandwidth, they always want to create room for high paying subscribers who demand unlimited bandwidth and consumed data volumes without restrictions. Therefore, most CSPs have an unlimited package or service offering available for premium users. Although, such packages do not have upper limits on bandwidth, CSPs usually want to have a policy in place called Fair Usage. This policy dictates that the bandwidth of a subscriber on an unlimited plan with no data volume cap needs to be reduced by an amount if the data usage reaches a predefined upper threshold within a certain time of the subscription period. For example, such a policy might say that reduce the bandwidth of a subscriber on unlimited plan by 200 Kbits/sec if she reaches an upper value of 20 Giga-Bytes in her usage/consumption of data volume before half of the month (assuming the subscription is on a monthly basis). The policy rule might say further that the bandwidth should be reduced by another 200Kbits/sec if the subscriber consumes 5GBytes volume in subsequent 5 days and so on. The idea behind such a policy is to be able to provide premium service to high paying users while remaining “fair” to other lesser paying users so that the unlimited customers may not occupy most of the bandwidth, thus leaving no room for other users.

To handle this use case, the following are the technical requirements for an advanced AAA solution.

### Technical requirements:

- Subscription management in HSS
- Session management and usage tracking
- Policy management
  - Fair usage is a policy and may have variants in different CSP environments. A sophisticated policy manager with a rule based engine to specify policy rules on subscriber related data e.g. subscription details, profiles and other parameters related to rating/charging etc. is an essential part of today’s advanced AAA platforms.
- Change of Authorization (CoA)

## On-Demand bandwidths

This is a very advanced use case where a CSP may want to give an option to the subscribers on their own self-care portal to increase their bandwidth as and when required for a given period of time. For example the subscriber self-care web-page may have a button and an associated time period with it e.g. one day or in 6 hourly time-slots where the subscriber may choose to increase the bandwidth to a higher level than the original subscribed one. The bandwidth returns to the originally subscribed one when the chosen period is over. This facility may be available to users who have bought this as an Add-on to the basic subscription.

To handle this use case, the following are the technical requirements for an advanced AAA solution.

### Technical requirements:

- Subscription and Add-on aware management in HSS or SuM
  - HSS is the main data repository for storing subscriber credentials, subscription information and add-ons etc.
- Policy management
- Change of Authorization (CoA)
- Subscriber self-care portal

## Application level control and charging

In this case, the OTT and other premium applications e.g. HD voice or video etc. need to be controlled individually by CSPs. The individual applications are considered as flows which may be pre-provisioned with the subscriptions and special premium rates and quotas associated with them. For example, a subscriber may be on a plan that offers 30% of the total subscribed bandwidth reserved for VOIP traffic, 20% for HD voice, 10% for torrents and the rest for normal Internet browsing. The subscription to the plan may also have monthly upper limits on the consumption of volumes for each individual flow. If the subscriber is not using a flow at any given time, the bandwidth dedicated to that flow is usually made available to her other flows. The basic requirement for this kind of use case is the capability of the network element acting as the service delivery point to be able to discriminate and enforce quotas on individual flows inside the subscriber's data traffic by deploying Deep Packet Inspection (DPI) techniques.

To handle this use case, the following are the technical requirements for an advanced AAA solution.

#### Technical requirements:

- Capability to push different profiles to network elements thus enabling them to enforce the quotas assigned to each flow during Authentication or Authorization.
- Subscription and Add-on management in HSS or SuM that is aware of the different profiles related to different types of quotas assigned to flows
- Flow based accounting and charging capability

### Congestion awareness and bandwidth control based on that (including throttling)

CSPs may want the network to remain free of congestion by avoiding running into the congestion state. This usually requires capability to monitor congestion in the network and there could be network elements dedicated to the task that generate real-time reports about the current usage of the network bandwidth on a global level. The CSPs may want to adjust the bandwidth of individual subscribers in active sessions and may also want to block or restrict new sessions to below a threshold till the state of congestion subsided.

To realize this use case, the following are the technical requirements for an advanced AAA solution.

#### Technical requirements:

- Capability to receive real-time reports from the congestion monitoring network elements
- Congestion control calculation module that would generate platform events regarding congestion
- Policy manager
- Change of Authorization (CoA)

## Conclusions

Due to the explosive growth of data centric services coupled with OTT applications, demand for bandwidth on access networks has grown exponentially in recent years. On one hand, this unprecedented growth has created new and interesting revenue opportunities for CSPs to offer differentiated and premium services for subscribers willing to pay more for additional bandwidth; it has also created significant challenges for AAA platforms that sit at the core of a CSP network. Now, AAA applications need to provide bandwidth management and control capability in conjunction with several other modules and applications such as Policy Managers, Subscriber managers, quota managers, self-care captive portals to name a few. AAA platforms are therefore quickly turning into complete Service Management platforms and must support capability for extensibility, scalability and programmability for realizing advanced business logic and use cases. In this whitepaper we have tried to capture some of the most important business use cases in the context of bandwidth management and the challenges these use cases pose for a modern AAA platform.

## About AdvOSS:

AdvOSS is an emerging B/OSS and Switching vendor that offers core-to-edge Billing, AAA & Call Control products to diverse range of Communication Service Providers (CSPs) across the globe. It provides customizable, scalable and cost effective solutions that add value and reduce overall operating expenses of Telecom Operators & CSPs.

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