



Controlling Network Inflation

How to Manage Heavy Usage
for Better QoE

 SANDVINE

The App QoE Company

Congestion and the Growing Heavy Usage Problem

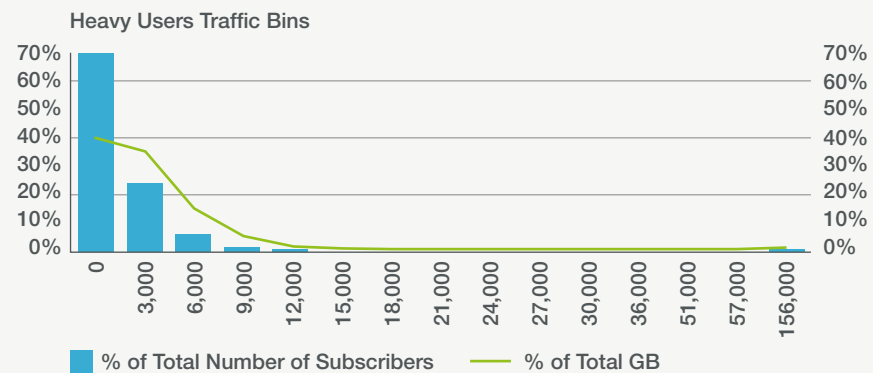
Network congestion can be caused by a variety of sources: an overburdened location, a highly popular and bandwidth-intensive application, inefficient TCP traffic, as well as heavy usage by a few users at the congested location.

Although these causes of congestion are all different, each directly impacts the average application quality of experience (QoE) delivered to the entire network, which ultimately impacts consumer perception of a network's performance.

Heavy usage is when network resources are disproportionately consumed by a small number of endpoints. Generally speaking, heavy usage can be defined by the "80:20 rule", where less than 20% of subscribers are taking up more than 80% of the network resources. In reality that ratio is getting much worse in many broadband networks. Some networks have ascertained that as little as 5% of their subscribers consume as much as 35-40% of network resources (Figure 1).

Figure 1

Network example of heavy usage



5% of subscribers consume as much as 35-40% of network resources

Everyone is a Heavy User

"Average household to use as much as 650 – 750 GB/month by the end of 2021"

Sandvine Global Internet Phenomena Report 2021

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Heavy usage is occurring globally on fixed, mobile, and satellite networks – no access type is immune.

The pervasiveness of heavy usage is a direct result of several factors: the constant influx of newer and more sophisticated applications, a significant part of the population embracing a smartphone-centered digital lifestyle, the uptake of work from home, and an accelerated adoption in the smart home market.

These factors are directly reflected in the global traffic patterns, where the top 6 tech brands are generating more than 50% of the traffic, which is a significant increase over the past couple of years (Figure 2). Supporting these in-demand services and applications require constant CAPEX investment.

Figure 2

Global traffic share by application

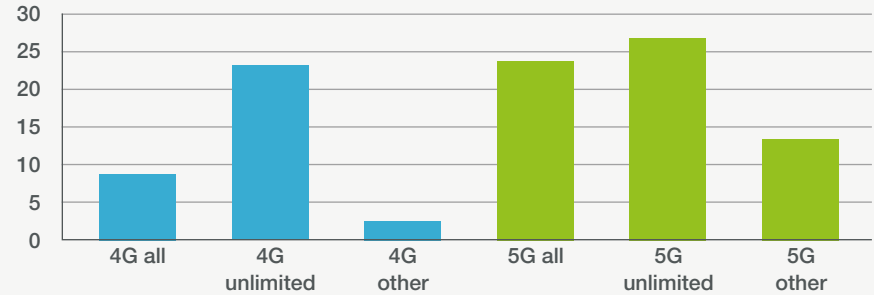
Brand	2019	2021
Google	12.00%	20.99%
Facebook	7.79%	15.39%
Netflix	11.44%	9.39%
Apple	3.97%	4.18%
Amazon	2.87%	3.68%
Microsoft	5.03%	3.32%
TOTAL	43.10%	56.96%

Source: Sandvine Global Internet Phenomena Report 2019 and 2021

Although next generation technologies (i.e., 5G in mobile and fixed wireless networks) seem promising, they will likely fall short in solving congestion and heavy usage. Initial 5G deployments have seen significant uptake – more than 2.5 times the consumption in comparison to 4G (Figure 3).

Figure 3

Mobile Data Usage – 4G versus 5G in an APAC Operator



Types of Heavy Usage

There are different sources of heavy usage, some malicious, some unintentional (Table 1). Regardless of the cause, it's important to identify and segment to employ the right method and approach, solving not only the behavior but also freeing up valuable resources and avoiding CAPEX overspend.

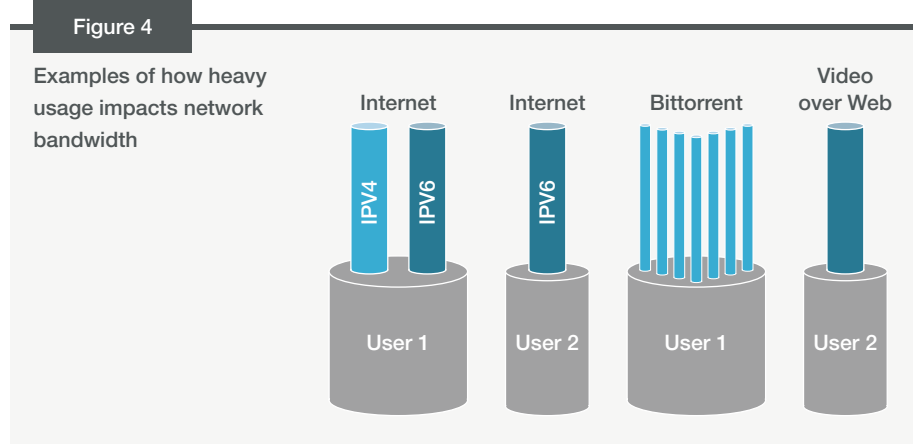
Table 1

Types of heavy usage

Type	Description
Dedicated P2P Seeder/ Leecher	Uses P2P traffic at full speed for upload, download, or both consistently
Pseudo Service Provider	Re-sells or shares its residential service to multiple users nearby without consent
Malware Zombie	Inadvertently generate high traffic and conn/sec due to being infected
Residential Hosting Server	High upload traffic for HTTP, HTTPS, and other TCP ports. Hosting services in residential capacity without consent
Heavy Video/Gaming Consumer	Generates heavy volumes of streaming video or gaming traffic for long periods of time
Simple Heavy/Power User	Digital lifestyle demands usage pattern that goes beyond a normal, average use of internet applications and media

Heavy Applications

Although subscriber behavior is a known culprit for causing heavy usage, it can also be caused by other factors such as IP dual-stack and the nature of applications (Figure 4). Specifically, dual-stack devices will always consume more bandwidth resources, which will continue to be a problem as the IPv6 adoption rate has so far proven to be a slow process. Similarly, some application (e.g., P2P and video streaming) create multiple TCP connections in parallel, attempting to gain more bandwidth to deliver the best quality as possible.



Aside from causing poor application QoE, unmanaged heavy usage can have direct business and financial implications for resource planning, service profitability, serving running cost, and the cost to brand reputation. Ultimately, it impacts all major teams:

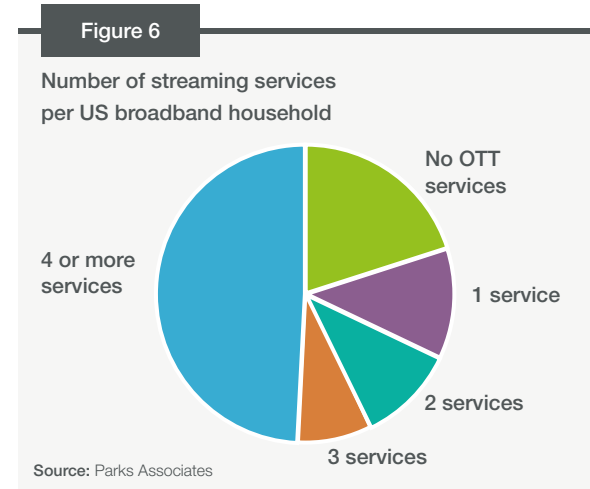
- **Operations** – maintaining SLAs and ongoing performance
- **Planning** – investment decisions shouldn't be made based on servicing heavy usage and users
- **Customer Care** – managing customer satisfaction when resources are disproportionate

Heavy Video

For many years, video has been a global dominating application category and shows no signs of slowing down (Figure 5) with mobile video traffic projected to account for [more than 79% of total mobile traffic](#).

Aside from the sheer volume of video consumption, another contributing factor is how video applications are designed – they will always default to the highest resolution and consume (arguably unnecessary) enormous amounts of bandwidth. With resolution, the associated bandwidth need isn't linear, as on average a 2K video consumes 3GB data per hour and a 4K stream consumes about 7.3GB per hour.

With almost [50% of US households subscribing to 4 or more services](#) (Figure 6) and the home entertainment trend having staying power, multiple HD/4K streams within a household is becoming commonplace.



Although, there is a big emphasis on video, gaming is continuing to influence bandwidth usage (Figure 7), especially as cloud gaming and real-time sharing of game streams on services like Twitch create simultaneous high bandwidth video and gaming traffic in a household.

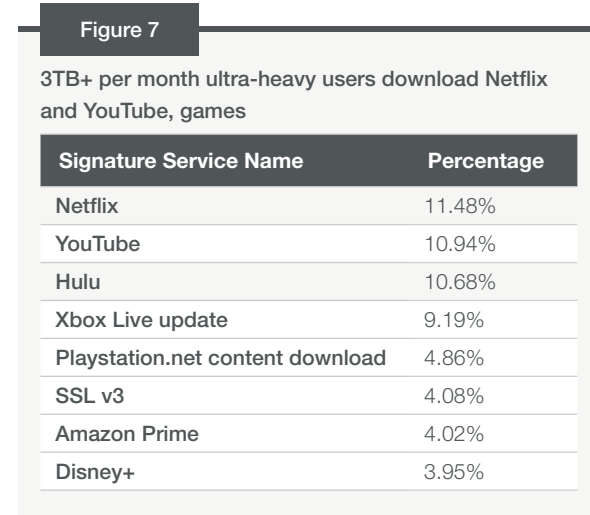


Figure 5

Global traffic share by application category

Category	Total Volume
Video	53.72%
Social	12.69%
Web	9.86%
Gaming	5.67%
Messaging	5.35%
Marketplace	4.54%
File Sharing	3.74%
Cloud	2.73%
VPN	1.39%
Audio	0.31%

Source: Sandvine Global Internet Phenomena Report 2019 and 2021

Managing Heavy Usage

Traditional Management Methods

Traditional methods for managing heavy usage (Table 2) have proven somewhat effective, but they fail to address the nuances associated with heavy usage, such as the difference between a power user and network abuse.

In fact, because these approaches have limited visibility, they can often punish subscribers by further degrading the QoE and fail to take advantage of revenue opportunities that exist when the right plan is sold.

Table 2

Different Methods for Managing

Method	Challenges/Issues
Capping All Heavy Users – Volume Count	<ul style="list-style-type: none"> • Profiling unfair usage is difficult • Treats every top user the same way • Does not distinguish between top users and ‘abusers’ • No help in congestion as congestion is location and time specific
Network-Wide Capping on Heavy Applications	<ul style="list-style-type: none"> • May help with congestion during peak times • Capping even when there is capacity in the network • Capping video network-wide impacts negatively on network performance perception because video is now an operator’s “KPI”
Quota-Tiering Versus Unlimited	<ul style="list-style-type: none"> • Multiple tiers with constant marketing for users whose usage needs grow • In a highly competitive market, quota-based plans are less attractive for some customer • Some users do not expect to pay a premium for their “legitimate” usage
Increase Service Cost	<ul style="list-style-type: none"> • Users will look for cheaper competition options • Gen Z customers are not convinced on paying more

What is the difference between power usage and network abuse?



Managing Heavy Usage

More than ever, it has become critical to take a proactive approach to manage heavy usage in order to preserve a positive QoE brand reputation.

A successful approach starts with visibility through a comprehensive understanding of heavy usage by application, usage pattern, time of day (i.e., peak times), plans, and (where necessary) location.

Aligning Heavy Usage Goals

Before tackling heavy usage, it's important to determine the business and financial goal or intention to ensure the right approach is employed as each method achieves different outcomes and results (Figure 8).

Figure 8

Aligning goals with management options

Why are you managing heavy usage?			
Access Network Optimization (alleviate load, ensure QoE, CAPEX Deferral, manage peak hours)			Service Differentiation (creating tiers to differentiate, upsell, user segmentation, quota top-up)
Congestion prevention and target SLA breachers	Manage average usage per user to achieve ROI	Actively optimize network usage and fairness per site	Monetize

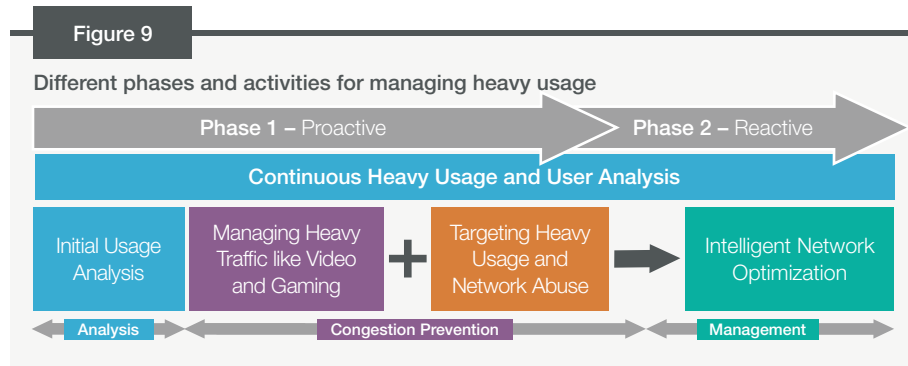
Before tackling heavy usage, it's important to determine intention



Sandvine's Solution

Sandvine provides a comprehensive solution to manage heavy usage, allowing for a prescriptive approach that aligns with planning, operational and business goals.

This multidimensional and phased approach offers proactive and reactive methods (Figure 9) based on goals and how much heavy usage has impacted network traffic and application QoE.



This solution leverages Sandvine's key capabilities, including leading network and application intelligence, contextual insights, and inline actions based on highly granular policies, across prominent use cases.

Depending on the set goals, two or more methods are combined to deliver an end-to-end solution that offers unparalleled visibility and surgical precision for identifying and managing applications.

Heavy Hotspots

Sandvine's solution can be deployed in any network type, addressing the entire network, or strategically placed to handle heavy usage hotspots. These hotspots are typically in the downtown or business districts in major cities, where congestion is not limited to peak hours but is almost constant during the day. Major benefits and bandwidth savings can be realized even with a conservative approach and spot deployments.

Network Neutrality and Network Management Regulations

Regulatory guidelines must also be taken into account when designing a heavy user management strategy, since each country differs in terms of what is deemed as "reasonable" traffic management. For example, there could be limitations in targeting individual applications versus application categories or targeting segments of customers versus prioritizing fairness. Regardless of the varying definitions, Sandvine's solution is flexible enough to deliver effective heavy usage management while complying with regulations.

Application QoE

Sandvine's QoE methodology goes beyond just an analysis or scoring tool, directly leading to sophisticated management policies based on desired QoE targets. Application QoE plays a role important role in identifying and managing heavy usage. Specifically, with Sandvine's QoE capabilities, suffering users, applications, and applications are easily identified through experiential scoring technology.

Application QoE is also instrumental in understanding the impact on QoE of different heavy usage methods, measuring the improvement experienced by users at either an individual or application level.

Classify and Categorize	Add Context	Ready to Use
<p>95% ACCURACY 2500+ Apps</p> <p>Bulk, Encrypted, Unclassified, Unmeasured Raw Data</p>	<p>Contextual QoE Metrics</p> <ul style="list-style-type: none"> Topology Content Location Route Subscriber Volumetrics Device Customer Type Demographics 	<p>Intelligent Data</p> <ul style="list-style-type: none"> Per subscriber Per application Per flow Configurable measurement interval (sub-second to five minute) Open schema and data layer

Analysis

Regardless of the goal and subsequent action, Heavy Usage Analysis is the starting point, providing the foundational visibility necessary to understand how and where heavy usage is occurring.

Heavy User Analysis (Subscriber Service Analysis + Custom Reports)

At the core of managing heavy usage is visibility and contextual analysis, answering critical questions such as who the heaviest users are. It can also provide insights into network utilization trends. This solution offers rich, custom reporting that allows data exploration for identifying key attributes and behaviors impacting application QoE.

To get a true understanding, Sandvine's Subscriber Service Analysis (**Figure 10**) provides a pre-packaged view of subscriber behavior, usage trends, as well as plans insights.

This use case:

- Monitors service performance and application QoE
- Shines a spotlight on the performance of individual services and network users
- Provides granular data to monitor:
 - Subscribers and subscriber groups
 - Services and service categories
 - Devices
- Enables a deep understanding of application usage trends by subscribers, viewed through plans, devices, classification, etc.
- Delivers distinct monthly user counts and volumetric application trends to drive service planning
- Offers a comprehensive usage profile for all service packages
- Produces precise application identification, detailed historical service trends, usage profiles for each service package, and additional context including location, plans, and devices

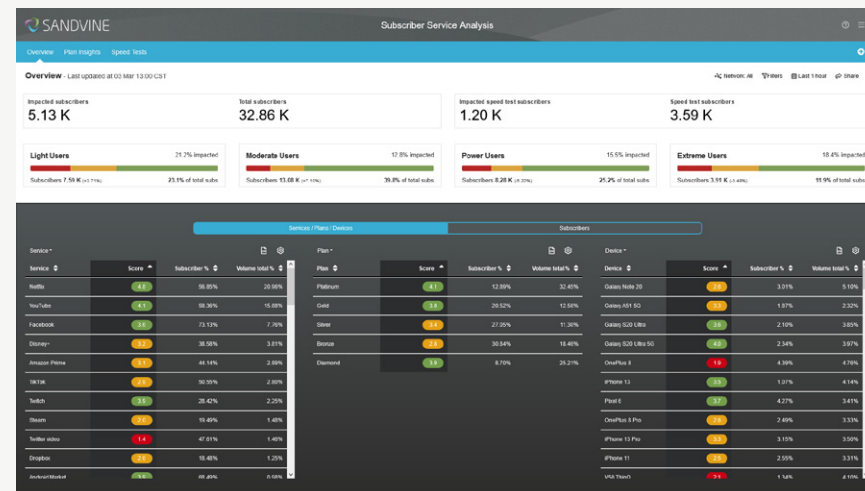


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Subscriber Service Analysis
Brief

Figure 10

Subscriber Service Analysis Overview



In addition to the analysis conducted via Subscriber Service Analysis, it's important to collect specific heavy usage statistics, including identifying:

- Top users and determine the top X% of heavy usage caused by Y% of the subscriber base
- Behavioral pattern and applications driving unfair usage
- Locations and access technology that are contributing to unfair usage and the difference in pattern
- Impact heavy usage is having on the overall QoE for all subscribers
- Types of devices that top users are using and the factors contributing to heavy usage
- Data plans contributing the most in unfair usage and if there is a relationship between plan type and unfair usage
- Top X devices, plans, services, service categories, locations causing heavy usage
- Trend of heavy usage with different dimensions over time (hourly, daily, weekly)

Proactive Management

Video Streaming Management

After analysis, Sandvine offers multiple ways to manage the heavy usage problem, proactively starting with Video Streaming Management, which is an effective and simple way to approach the problem. Even by implementing this one method, a significant amount of network resources can be saved.

Targeting bandwidth-intensive applications, such as video, can garner a quick win because (as stated above) video is often a large contributing factor to heavy usage behavior and to exacerbate matters, most video steaming services will demand maximum bandwidth – regardless of screen size – equating to significant waste of network resources.


With Video Streaming Management, manage video resolutions by application, device, time of day, and location, allowing for a more efficient and consistent video experience.

Aside from cost savings, Video Steaming Management also offers revenue opportunities, such as offering premium plans with higher resolutions or even offering unlimited video plans (for an additional fee) with lower resolution. Video Streaming Management provides the insight and visibility to determine the impact of policy changes.

Heavy User Management

Going beyond application management, heavy usage can be addressed from a user perspective, targeting those top users (or abusers) for either management or potential upsell.

Segmenting users is paramount when faced with heavy usage, it's useful to determine if there are power users who would better served with a different (higher revenue) plan or if there is abuse (detailed in **Table 1**). Sandvine's Heavy User Management offers multiple options to manage heavy usage at a subscriber level (based on segment shown in **Figure 11**), starting with hourly to monthly monitoring and policies. Specifically, policies could be set that if a user reaches a significant threshold within a given time period, such as a day or week, even on an unlimited plan, then their throughput will be reduced, freeing up

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more bandwidth for the rest of the subscriber base.

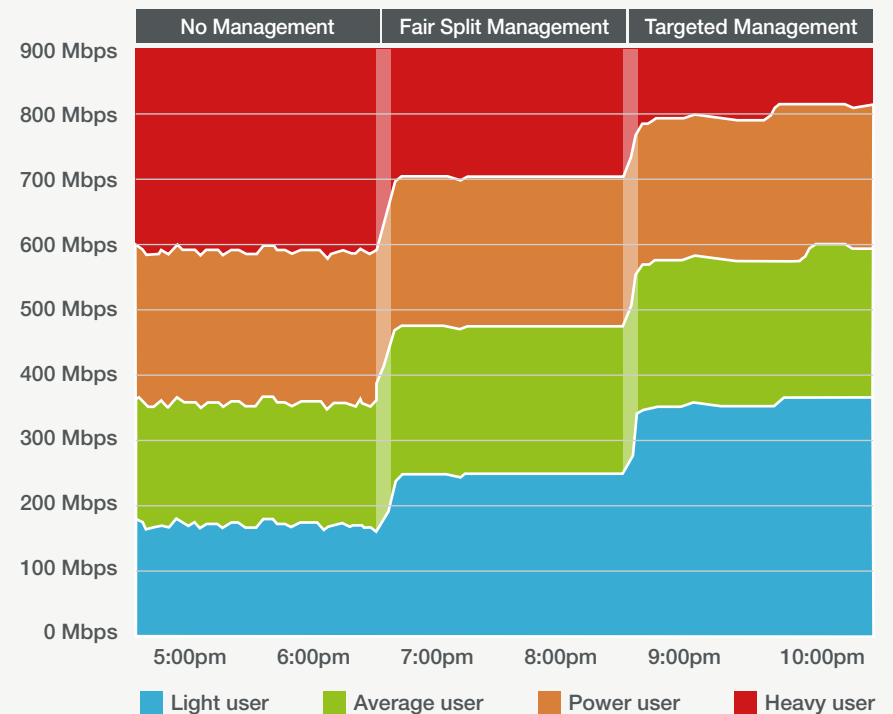
With Heavy User Management:

- Design flexible, targeted policies for usage management with multiple quotas and thresholds (e.g., hourly, weekly, etc.)
- Learn top user volume, total volume, number of top users, total number of users, and the change occurred from the last time window
- Monitor which applications are most consumed by the top users and the volume generated
- Compare heavy usage trends to overall usage
- Understand the policy impact and validate ROI

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Figure 11

Comparing results



Congestion Management

When heavy usage is left unmanaged and a network has reached a level of organic growth that can no longer be serviced by existing capacity, a more intelligent method needs to be employed to truly address the congestion caused by heavy usage, along with other factors, and the impact on application QoE.

Sandvine offers an intelligence-based congestion management solution targeted at improving the application QoE for the majority of the users at a given location. This use case addresses the congestion issue in both mobile and fixed networks with a difference in the approaches.

These two solutions are designed to be more sophisticated than traditional methods that rely primarily on manual intervention and are unable to dynamically respond to changing network conditions.



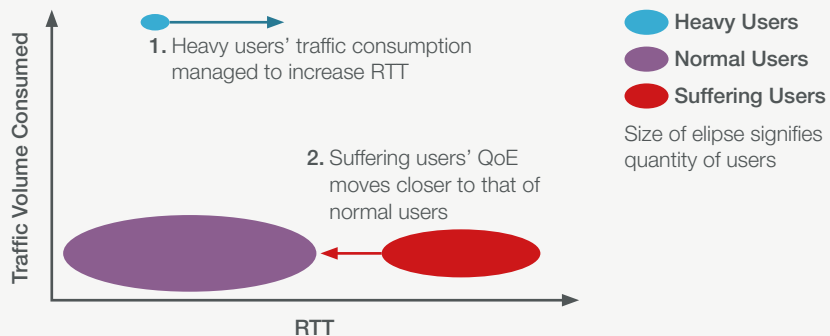
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Intent-Based Congestion Management – Mobile

Sandvine's Intent-Based Congestion Management solution uses heuristics, real-time congestion detection and subscriber and application intelligence, to selectively shape heavy users during congestion to improve suffering users QoE (Figure 12), and target to increase average throughput per user in congested cells.

Figure 12

Managing heavy usage of video streaming applications allows improving QoE of the suffering users



Intent-Based Congestion Management – Fixed

Designed for fixed and fixed wireless access networks, Intent-Based Congestion Management implements application-specific policies to achieve automated network management – without requiring any continuous manual parameter fine-tuning.

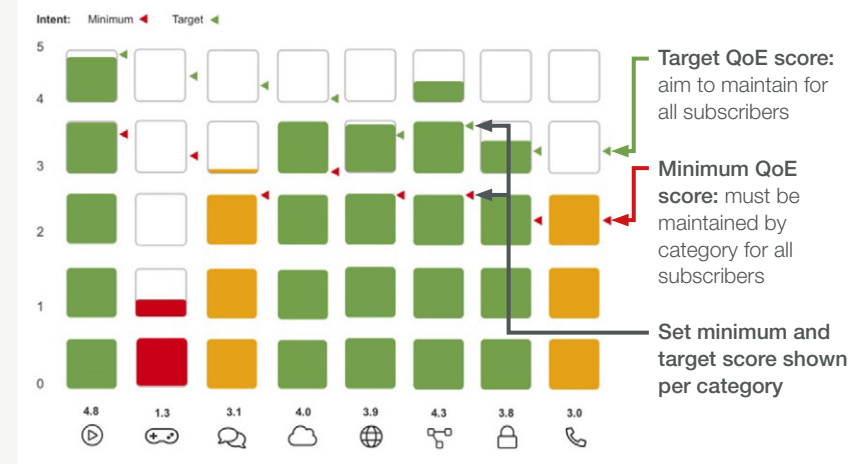
Furthermore, it simplifies the congestion management policy by using a target (ideal) and minimum application QoE score for each application category (Figure 13), ensuring that important application categories are given the right resources during congestion. Given its closed-loop design, it continually monitors the application demand by resource and determines allocations to achieve target score intents.

With Intent-Based Congestion Management:

- Learn status and target scores for location
- Keep an eye on minimum and target score shown per category
- Get a view of most and least congested locations
- Identify problem locations that are not meeting the intent
- See algorithm decision and result if the target was met or not

Figure 13

How Application QoE is used to set automated congestion policies



Monetization

A commonly overlooked part of managing heavy usage is the monetization aspect. Simply, identifying power users (those who consume above a defined threshold but aren't abusing the network) and offering them a personalized plan can achieve bandwidth savings and increased revenue.

As stated, conducting ongoing analysis on who the top users are and correlating that with their plans will guide upselling activities, including plan personalization.

Sandvine provides two great tools for creating plans, Usage-Based Services, and Zero-Rating and Application-Based Plans. They can be used individually or combined to deliver larger or innovative and personalized plans that create benefit for power users, while reducing some of their heavy usage.



Click here

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Usage-Based Services Brief



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Zero-Rating and Application-
Based Plans Brief

Deliver larger or innovative and personalized plans that are mutually beneficial



Managing Heavy Usage Isn't One and Done

Managing heavy usage is an ongoing set of activities (Figure 14), always coming back to analysis to determine where and why the problem is occurring, and then using the right method at that time to tackle it.

Sandvine makes this process more effective by leveraging application and network intelligence capabilities, which creates a strong visibility foundation for managing heavy usage, preventing further QoE degradation.

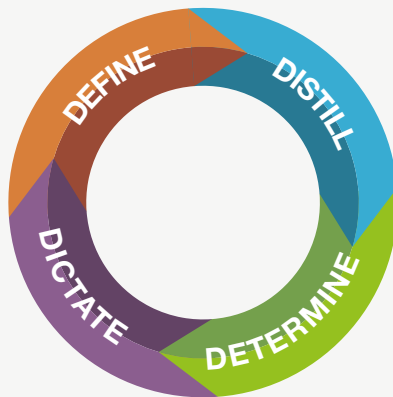
It specifically addresses the various causes with a variety of tools to suit the intended goal, and leverages Sandvine's sophisticated congestion management capabilities to handle heavy usage with surgical precision. By using this solution, heavy usage can be managed, improving QoE for all and increasing revenue and customer satisfaction.

Figure 14

Managing heavy usage on an ongoing basis

4. **Define** and configure policies for managing heavy usage

3. **Dictate** heavy usage detection thresholds



1. **Distill** heavy usage impact on network by volume

2. **Determine** the cause of heavy usage (i.e., application, behaviors, locations, etc.)

Handle heavy usage with surgical precision



ABOUT SANDVINE

Sandvine's cloud-based Application and Network Intelligence portfolio helps customers deliver high quality, optimized experiences to consumers and enterprises. Customers use our solutions to analyze, optimize, and monetize application experiences using contextual machine learning-based insights and real-time actions. Market-leading classification of more than 95% of traffic across mobile and fixed networks by user, application, device, and location creates uniquely rich, real-time data that significantly enhances interactions between users and applications and drives revenues. For more information visit <http://www.sandvine.com> or follow Sandvine on Twitter [@Sandvine](https://twitter.com/Sandvine).



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