SANDVINE

Congestion Management
Manage networks more effectively and ensure higher quality services

USE CASES FOR CONGESTION MANAGEMENT

Fair Use Management
During times of congestion, manage traffic so that all users have equal access to bandwidth or are allocated bandwidth according to the terms of their service contracts

Video Streaming Management
Apply policies that adjust video bandwidth to reduce traffic volume but continue to provide a high-quality user experience

Heavy User Management
During times of congestion, increase the overall quality of service by limiting the amount of bandwidth available to the few heaviest users and allocate that bandwidth to the many users consuming more modest amounts of available bandwidth

Manage any network
Sandvine congestion management supports any type of network and includes network specific management capabilities to optimize traffic on a per network basis

Congestion has always been a high priority network issue, and concerns about managing congestion show no signs of abating for the foreseeable future. Simply put, networks become congested when demands for resources exceed resource capacity. That resource capacity is bounded by two overriding concerns: the cost of or the return on that capacity and the Quality of Experience (QoE) delivered to customers.

Yes, networks are designed to be responsive to customer and user traffic requirements, to handle peak loads, and to provide reasonable returns on network investments. Yet in practice, networks cannot be economically built to deliver against all potential future requirements because customers can present rapidly changing needs, peak loads can vary wildly, and ROI and budget projections can falter in the face of competitive pricing pressures and other business related issues.

Enter congestion management, which aims to provide more with less, stretching capital and operational resources so they may provide higher quality services without having to commit more capital to network and operational expansion.

USE CASE TECHNOLOGY OVERVIEW
Congestion management may take many forms. Operators and enterprises can analyze historical trends for planning purposes but this approach is not helpful as a method for responding to real-time network congestion issues which require dynamic and automated actions rather than static rules and rote or manual actions.

Sandvine takes the more dynamic and automated congestion management approach, combining traffic management with policies that take action when and where needed. The solution provides far more more precise and effective congestion management based on a much broader set of conditions which can include:

- Priority by application or application type, by source or destination, and by network type
- Personalized subscriber-related attributes such as recent usage, service plan, and type of device
- Real-time feedback loop monitoring of QoE metrics at locations throughout the network which can then trigger actions to maintain specified quality levels

Figure 1 on the following page demonstrates how different congestion management approaches can be applied to allocate bandwidth more equitably during non-peak and peak times. Note that the much parger population of Normal, Light and Very Light bandwidth users receive a "fairer share" during times of congestion.

Figure 1

Congestion Management is versatile, taking many forms
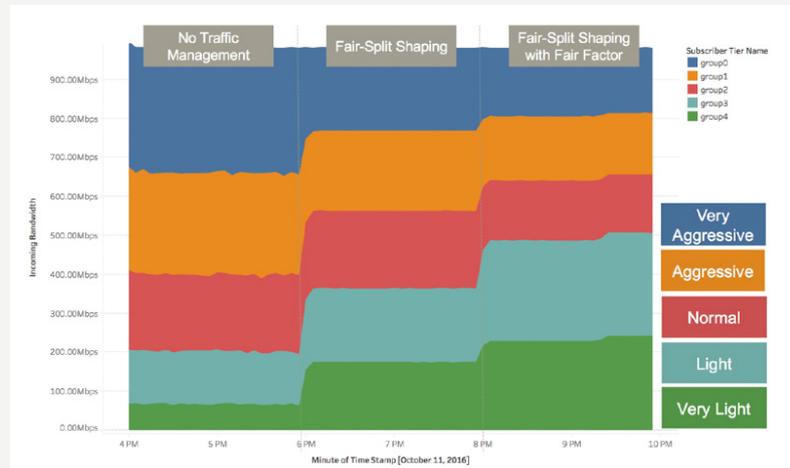
Use Cases

Sandvine's congestion management works across all network access types and includes unique, network specific features tailored for even more effective congestion management within mobile, cable, satellite, or WiFi networks. The solution can also operate in conjunction with network neutrality traffic management guidelines such as only shaping traffic when congestion is detected or for application classes rather than for specific applications.
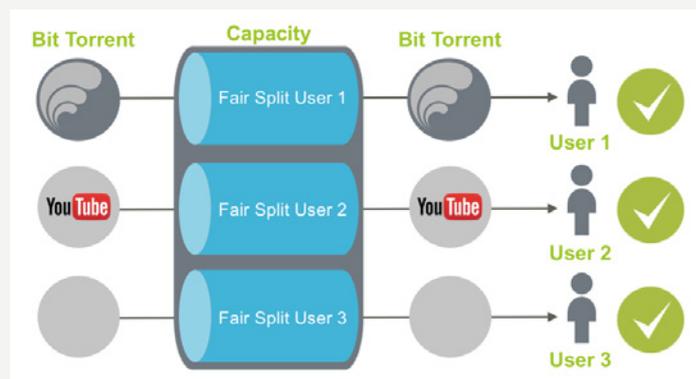
Mobile Congestion Management

Mobile network performance is highly visible and mobile traffic is growing at rates that outpace the growth of all other network traffic types. Operators are having troubles building out their networks fast enough to keep up with demand. Clearly, there is a great need to stretch the mobile resources already deployed and to have the tools to better manage the quality of experience that customers receive.

Mobile network congestion is unique in many ways including that mobile subscribers are not stationary, so demand for throughput may vary greatly by conditions such as time of day, weather, type of devices in use, applications in use, and more. Operators must consider both congestion management policy as well as the addition of infrastructure, as one or both may be needed to satisfy the bulk of customer issues. For example, if the main congestion issue is that traffic is not equitably provided across subscribers, fair use policies are likely to provide more immediate, positive outcomes than would the addition of more mobile infrastructure.

Figure 2

Fair-Split ensures fairness among all active subscribers

Sandvine's mobile congestion management provides the following capabilities that are particularly important for mobile networks including:

- Mobile video and heavy user bandwidth management

- QualityGuard Congestion Response System for RAN performance metrics, incorporating real-time mapping of subscribers to their RAN locations to maximize network utilization and QoE

- Congestion detection at the cell or the base station level

- Handheld device identification to personalize and optimize content at the device level

- Real-time QoE scoring to identify trouble areas in the RAN network

- Tackle congestion with different approaches such as video traffic control, heavy user control, selective app control, and app prioritization

- 3GPP compliant policy control and charging interfaces for rapid integration with policy control enforcement functions (PCEFs) or Policy and Charging Rules Functions (PCRFs).

Cable Congestion Management

Cable networks are broadly deployed and are a leading method for delivering broadband fixed access to the home. Cable speeds are impressive, with the latest standards supporting gigabit and multi-gigabit speeds. Yet even with such impressive top-end speeds, traffic congestion remains a problem because, like all broadly deployed networks, cable networks are shared resources and cable providers have to look for promising returns on their network investment.

Cable networks adhere to the Packet Cable Multimedia (PCMM) standard which includes rudimentary QoS capabilities. PCMM-based QoS is based purely on layer 3 information, which is not application aware and not capable of effectively managing congestion. Sandvine's cable congestion management solution augments PCMM QoS with an advanced policy management platform that enables cable service providers to deliver dynamic, real-time QoS on a per-user, per-application basis.

The Sandvine Cable Congestion Management solution also provides:

- Mobile video and heavy user bandwidth management

- Topology mapping matching subscribers and their traffic to all potential cable modem termination system (CMTS) interfaces calculating channel and bonding group supersets to apply highly granular congestion management

- Integration of the CMTS's IPDR, the PacketCable Multimedia (PCMM) PCMM, and SNMP and SNMP interfaces provides much richer visibility into the network and more flexible upstream and downstream traffic policy enforcement

- Minimum rate threshold shaper allowing operators to guarantee a minimum bandwidth for traffic as a percentage of the CMTS interface speed

- Real-time QoE scoring to identify trouble areas in the cable network

- Fully compliant with DOCSIS 1, 2 and 3 and other relevant CableLabs standards including IPDR, PCMM, and SNMP for vendor agnostic support for industry leading CMTS vendors.

Satellite Congestion Management

Satellite networks have several unique, congestion management challenges based on their reliance on limited beam bandwidth, their extreme round-trip, traffic latency times that can approach 500 milliseconds, and their TCP timestamps which are often obscured by isolated, end-to-end acceleration systems.

Sandvine satellite congestion management allows operators to get the most out of the available beam capacity, maintain customers' bandwidth SLAs across the footprint, manage congestion at the subscriber, application and beam level and enforce fair use policies in real-time.

Figure 3

Guaranteeing committed
information rates
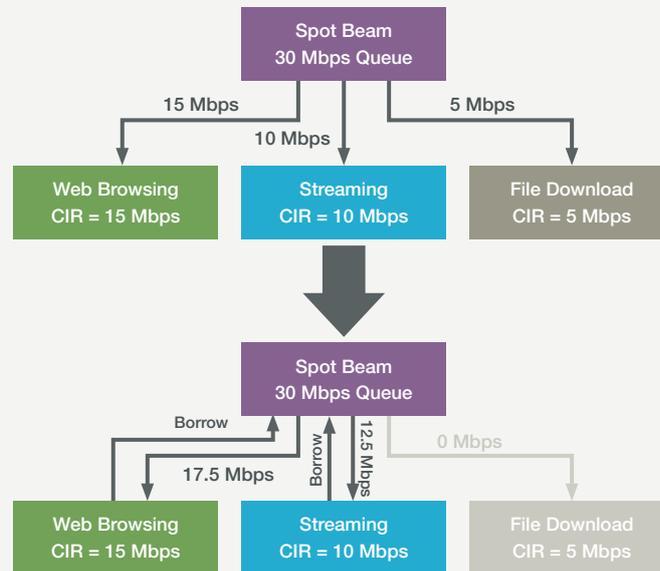
In **Figure 3** (above) Bandwidth borrowing allows operators to implement a series of hierarchical queues, where each child queue is guaranteed a committed information rate. Here the spot beam represents the parent queue, and the child queues represent sub-elements utilizing the beam such as application group, aircraft, sea vessel, or end-users.

Key capabilities include:

- Support for multi-layered shaping schemes that map to various network entities (for example, beam capacity, application committed rate, per-user limit) to effectively allocate resources
- Integrates with third-party mobility managers to mirror topology changes in real-time when user terminals are reassigned to different beams
- Hierarchical queues that allow for the borrowing of bandwidth to accommodate traffic rates that go well beyond committed information rates
- Integrated TCP acceleration for reduced latency and smoother management of TCP based traffic
- Traffic prioritization based on use class—passenger, crew—and application
- Tiered services in conjunction with sophisticated congestion management algorithms enable a broader set of offerings and price points to maximize value.

WiFi Congestion Management

WiFi access technology has become crucial for network operators because it now acts as the primary network extension to cellular networks, providing welcome relief to overburdened RANs. WiFi is also considered essential in public venues like airports and stadiums which are usually designated offloading sites for network operators as well. Despite the fact that WiFi is often provided free of charge, consumers consider it an essential utility and expect good quality WiFi connections.

WiFI congestion management is largely different from that of other access networks in that it is applied at the access point (AP), site router and wireless LAN controller (WLC) levels. This hierarchy is important because it is at these three levels that congestion management can be applied—providing the contextual awareness (subscribers mapped to AP, site router or WLC) needed for critical performance intelligence and follow-up actions.

Key capabilities include:

- Completely vendor agnostic and can be integrated with any WiFi vendor's AP and WLC
- Deployments can be centralized or decentralized (network or cloud based), and the features remain consistent across all deployment models
- Data can be integrated with operator network operation tools for automated alerts and ticket generation
- Sandvine analytics can provide per subscriber scoring for a localized view of WiFi network performance, exposing hotspots and coverage holes
- Broad application signature database which allows operator to uniquely identify application groups and individual applications for deeper insight into usage behavior
- Operators can apply application level traffic prioritization (based on subscriber identified virtual services)
- Fair Use management balances traffic equitably amongst users, allowing operator to better manage customer experience during times of congestion.

SANDVINE'S UNIQUE CONGESTION MANAGEMENT BENEFITS

More Critical Use Cases Supported

Sandvine congestion management supports more of the use cases that help network operators run their networks and businesses more effectively and profitably. Fair use, heavy user, and video streaming management are just three of the key use cases that Sandvine's congestion management technologies deliver, all with the carrier-grade precision and flexibility that are needed for today's complex and multipurpose networks.

Application Awareness for Higher Quality of Experience

Delivering the industry's best application identification with the largest and most precise library of application signatures. Application awareness is an important dimension to consider and manage to ensure better customer experience in cases where congestion does occur.

Flexible Traffic Policy and Control Logic

Powerful and agile policy management with multiple inputs from different sources enabling real-time policy control on a per-subscriber basis across multiple context and service dimensions.

Network Neutrality Compliant

Flexible and feature rich congestion management allows operators to choose traffic management policies that fit to the network neutrality requirements of their particular regions.

Quality of Experience Trend Monitoring

Providing analytical tools, such as ScoreCard, which measure the quality of experience delivered across key traffic, subscriber, and other dimensions. These analytics help operators worldwide track their quality and identify areas where more attention or investment may be needed.

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