SANDVINE

Gaming QoE Analysis

Analyze critical gaming QoE metrics

GAMING QoE ANALYSIS DELIVERS:

- Updates signatures frequently to keep pace with changing gaming application algorithms, codecs, and protocols and also the launch of new gaming service providers
- Leverages machine leaning technology required for accurate classification of encrypted gaming traffic and QoE calculation
- Performance metrics at sub-second granularity required for detailed modeling of subscriber experience
- A single solution for QoE scoring all critical application categories as well providing the ability to conduct further analysis at a per subscriber, per service score level
- Insights based on aggregated, network-wide key performance indicators, granular usage statistics, as well as gaming quality, and other aspects of gaming: hosting and delivery (Servers, CDNs), access network (locations, cells, POPs), and consumption (device types devices, subscribers).

MARKET OVERVIEW

Similar to video streaming, gaming has become an internet phenomena in its own right over the past couple of years, with a steady rise in traffic volume – especially on the upstream link.

Gaming is the #1 growing internet service of 2020 Sandvine Global Internet Phenomena Report 2020

Contributing to this growth is the global stay-at-home orders, which have fundamentally changed gaming traffic patterns **(Figure 1)**. Another key contributor is the evolution in the gaming market, including the introduction of cloud gaming and the surge of new game providers (like the fragmentation experienced by the video market).

Gaming Traffic Categories

- **Download:** The ability to download entire games or updates (patches) and play offline.
- **Online/Interactive Gaming:** The ability to play a game on local specialized devices such as Xbox, PlayStation, or running part of the game software on a PC, locally.
- **Cloud Gaming:** The ability to play a game on any device without owning the physical hardware required to process it, or needing a local copy of the game itself.

Global Application Ranking Based on Total Traffic

PlayStation explodes with growth

XBOX LIVE
Rank **12**
2020 Growth **+72%**

PLAYSTATION Network
Rank **8**
2020 Growth **+107%**

STEAM
Rank **18**
2020 Growth **+72%**

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Figure 1

Gaming traffic changes

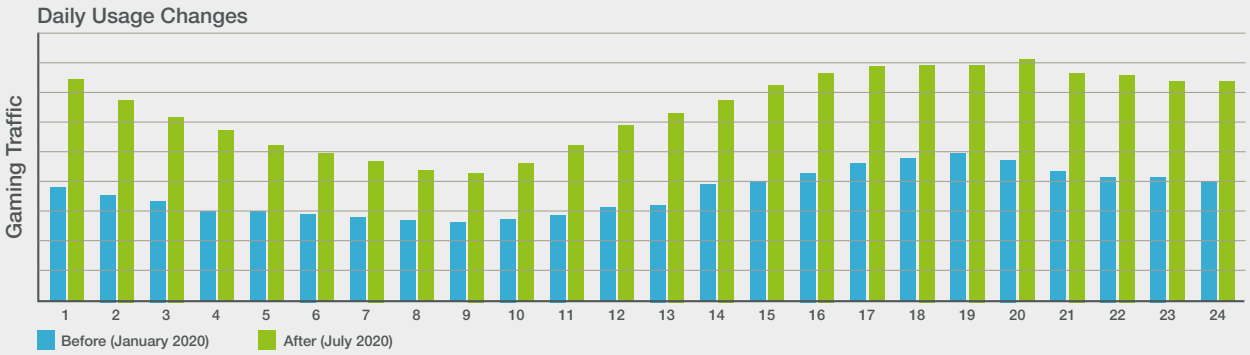

Table 1: Gaming Network Requirements by Category

Gaming Traffic Category	Throughput	Latency	Jitter	Impact on Other Traffic
Download	High	Medium	Medium	High
Online/Interactive	Medium	Low	Low	Medium
Cloud	High	Very Low	Very Low	High

Just like video, gaming is highly sensitive to congestion, and in fact is far more bandwidth-intensive than its real-time entertainment counterpart. It is also one of the applications consumers "benchmark" when evaluating their provider's performance. However, unlike video, gaming impacts network requirements differently, and those will vary by game category **(Table 1)** and game type **(Table 2)** and result in different poor QoE symptoms **(Table 3)**.

Table 2: Gaming QoE Requirements by Type

	Throughput	Latency	Packet Loss	Jitter
Battle Royale/MOBA	Highest	Low	Low	Low
Real-Time Strategy	Low	Medium	Medium	Medium
First Person Shooter	High for console games, lower for mobile	Low	Low	Low

Table 3: Poor Network Performance Impact on Gaming Quality of Experience

Poor Latency (Lack of Throughput) Symptoms	User Experience	Game Types Effected
Lag	Game play stutters or does not respond to user input realistically	MMO, FPS, any real-time play
Time Jumps	Misaligning client predictions with server state causes jumps and sudden changes in client game state	Shooters and other real-time play
Slow Loading	Delays in initiating sessions or moving to a new map while data is being downloaded	MMORPG, turn-based gaming, immersive graphical experiences
Failed Downloads	Download of new game or new module to existing game fails	Any game with a client
Buffering Video	Game viewing buffers or video fails to start during event or replay	eSports (all online game types)

Gaming QoE Analysis

Typically, gaming has been console-based and limited to fixed networks. However, the improved performance of 4G has also made mobile devices an attractive option for gamers, and with the adoption of 5G this upward trend will continue. Historically, gaming QoE has predominantly been defined by latency (and packet loss). However, cloud gaming changes this QoE requirement by delivering a 4K quality video on the downstream and placing new levels of sensitivity on the upstream latency – which most networks aren't equipped to handle.

As gaming continues to rise in popularity (including broadcasting via Twitch and Mixer), service providers need to know how gaming sessions are performing and are experienced by gamers. With this information, service providers can ensure acceptable QoE levels, while preventing large downloads from consuming already strained bandwidth.

Service providers are evolving to service-centric monitoring to improve QoE and reduce customer churn. In the case of gaming, this monitoring requires a contextual view of gaming QoE including individual locations, service plans, devices types, and other key attributes; many analytics solutions are not up to the task.

Many solutions fall short as they lack end user experience visibility, or rely on sampling. To truly measure Gaming QoE, a solution must be able to detect and measure user actions and the behavioral characteristics of the gaming itself. Also, the solution must do so in an environment where content associated with any individual stream can be split across multiple flows, and an individual household, mobile hotspot, or other analogous point, can have multiple concurrent gaming streams in play.

With the right solution in place, every single gaming session is a chance to measure and monitor network experience. By truly measuring gaming QoE from the viewer's perspective, service providers will be in a position to make an informed decision and choose the best actions to improve QoE, minimizing churn risk.

Gaming QoE Analysis can be leveraged by the following teams:

- **Network Planning:** Network capacity planning (based on gaming consumption and forecast), and edge computing sites location determination based on geo-distribution of gamers and measured latency
- **Customer Care:** Determines proactive, actionable insights for potential root causes and remedies (especially where Gaming performance is poor)
- **Product Management:** Insights and churn prediction based on experience and consumption of gaming traffic

USE CASE OVERVIEW

Sandvine's Gaming QoE Analysis enables service providers to measure the right gaming QoE metrics and KPIs for specific gaming applications, and closely monitor, report, and analyze gaming traffic to understand performance trends.

Gaming QoE Analysis metrics, include:

- **Throughput (bandwidth):** calculated every 256 milliseconds to capture spikes and sudden bursts needed to download games or render game view
- **Latency:** both internet and user side, calculated every 1 or 5 seconds
- **Packet Loss:** both internet and user side, calculated every 5 seconds
- **Jitter:** both internet and user side, calculated every 1 second
- **Inter-Packet Arrival Time:** both internet and user side, calculate every 1 second

Gaming metrics and scores are calculated per user, per application, per location, and per device in real time. With these KPIs, Sandvine provides service providers a comprehensive picture of the quality experienced, which is necessary for conducting root cause analysis within customer care and planning systems.

Service providers benefit from the following key capabilities:

- **Rich, Network-Wide Visibility:** Sandvine has the largest signature gaming protocol capability in the market. This use case enhances intelligence-based gaming protocols, grouping them by: online/interactive gaming; cloud gaming; and gaming downloads.
- **Advanced Metrics for QoE:** Each gaming segment has different needs and requirements; individual QoE gaming scores will be calculated for each gaming segment. Specific metrics

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associated with gaming are required to understand an end user experience, while utilizing a gaming service across the network. Sandvine's QoE scoring algorithm is validated and maintained through specially designed crowd-sourced tests and periodic randomized control tests. Scoring is transparent and easily interpretable with network metrics.

- **Accurate Classification:** Sandvine leverages machine learning to uniquely classify and measure traffic, delivering rich visibility into QoE and gaming service usage, regardless of gaming application encryption. This accurate classification allows Sandvine to further separate traffic – online/interactive gaming, cloud gaming, and gaming downloads – allowing each category's distinct behavior and customer expectation to be addressed.
- **Actionable Intelligence:** Intelligence can be actioned with a Network Optimization solution to manage gaming quality based on the root cause of degraded gaming QoE. This intelligence will ensure the best policies can be implemented to manage bandwidth and QoE performance for gaming and the rest of the network.
- **Holistic View:** Sandvine's Active Network Intelligence (ANI) Portal displays a comprehensive view of gaming usage **(Figure 2)** in the service provider's network, including usage statistics, gaming quality from both a client and device perspective, delivery performance and quality for hosting services and CDNs, and location-specific quality metrics.

Figure 2

Gaming Overview in Sandvine's ANI Portal

This overview highlights key metrics: Volume, Gamers, Gameplay time

By deploying Sandvine's Gaming QoE Analysis use case, service providers take advantage of critical gaming insight – QoE, devices, usage, services – to deliver a better gaming experience, while managing bandwidth consumption.

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**.

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