SANDVINE

phenomena

THE **GLOBAL** INTERNET PHENOMENA REPORT **MARCH 2024**

Like our Cosmos, the Internet is a Vast, Expanding Universe

Peering into its mysteries reveals its current and future impact on networks and App QoE

SPOTLIGHTS

The **Truth** About Gaming

Upstream Traffic Matters More Than Ever

Going Deeper With App User Volume

ABOUT SANDVINE

Sandvine recognizes that telecom service provider brands are inextricably tied to application quality of experience (App QoE) – the best measure of real-time customer satisfaction. Whether video, messaging, social media, or collaboration, the application is the subscriber's primary interface with the network.

To optimize App QoE to the most customers, application and network intelligence must be rooted in data that can drive better business outcomes. That's why Sandvine uses a unique combination of data management, network infrastructure, and application solutions to accurately identify, categorize, and classify more than 95% of all internet traffic across all access types.

Sandvine's 20+ years of experience with the world's most innovative operators brings unparalleled expertise to analyze, optimize and monetize networks. Using advanced heuristics and machine learning-based App QoE scoring, we help service providers accurately identify who, what, when, and where App QoE issues are occurring, enabling operations teams to quickly resolve problems, and planning teams to precisely plan for future growth.

From the CTO to customer care, Sandvine's App QoE focus will improve operations and planning. while reducing costs and improving customer satisfaction

App QoE at multiple levels uncovers the unseen

95%
Accuracy
2500+ APPS

What is the application QoE:

- per location?
- by user segment?
- per device?
- by plan?

Guided Workflows

What	Who	Where	When
What is being impacted?	**Who is being impacted?**	**Where is the impact occuring?**	**When did it happen?**
Application	Individual subscribers	Locations	Time of day
App Category	HVAs	Slices	Peak hours
App Content Category	Enterprises	Specific nodes	Trends
	Specific devices		
Drill down to "why?" – most likely cause with recommended next best action			
Closed-loop Automation to implement recommended next best action			

Better data accuracy leads to better planning, troubleshooting, and monetization.

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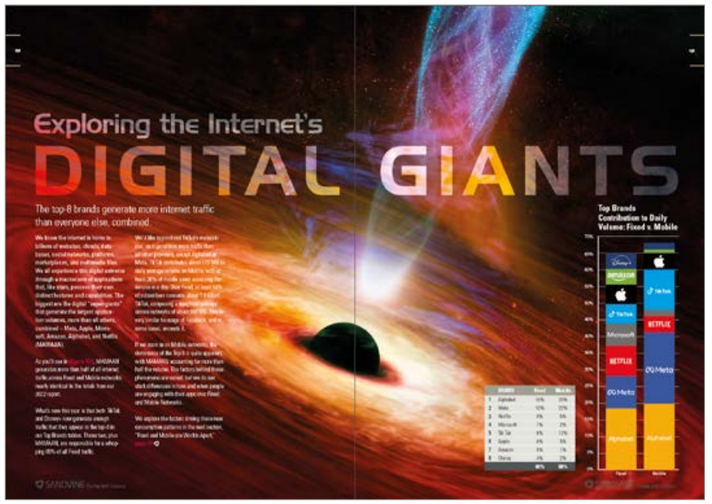


Sandvine 2024
Global Internet Phenomena Report

EXECUTIVE SUMMARY

In this report, we use our AI-driven application identification, classification, and content categorization engine, AppLogic[1], to discover and visualize the phenomena that characterize today's broadband networks. By measuring Application Volume, Application User Volume, and Application Popularity, we can better understand the impact internet applications have on network resources and on subscribers' App QoE. (See: New Methodology, Page 5).

Using a powerful combination of state machines, parsers, analyzers, behavioral correlations, and machine learning, AppLogic detects phenomena across different access networks, devices, and regions.

Using AppLogic's identification and visualization, we see more clearly the internet phenomena that define today's networks, and we convey their significance in the tabular data and insights in this report's pages. Some of the highlights we will describe include:

- The average total volume of internet traffic across all networks worldwide is nearly 33 EB per day – with approximately 22 EB of total volume over Fixed networks; and 11 EB over Mobile.
- Meta, Apple, Microsoft, Amazon, Alphabet, and Netflix (MAMAAN), plus TikTok and Disney+, are the digital "super-giants" in terms of application volumes, accounting for 65% of total internet volume.
- In our Application Categories, Video is by far the biggest culprit when it comes to downstream traffic volume over both Fixed and Mobile networks, responsible for 38% of the traffic at an average total volume of 15.7 GB per sub per day. Over Fixed alone, Video accounts for 39% at 5.7 GB per subscriber per day, while in Mobile, it accounts for 31% of the total volume, at 493 MB per subscriber per day.
- In our Content Categories, On-Demand Streaming is the type of Video that generates the most traffic, with per-subscriber volume of 7.9 GB per day (54% of total downstream volume). Of that volume, we find the app that drives the most traffic is YouTube, contributing 1.9 GB per sub, per day, with Netflix in second at 1.4 GB per sub per day.
- As we explain on page 10, average downstream subscriber volume in Fixed networks is 14.5 GB; and 1.2 GB for upstream – much larger than Mobile's averages of 1.6 GB and 0.1 GB. This indicates people are waiting to watch bigger videos over Wi-Fi, opting to instead do Social Media over mobile devices, while on the move.
- Social Media is the biggest App Category in Mobile networks' downstream traffic, with 35%, and 7 of the top 10 apps attributable to Facebook, TikTok, Instagram, Snapchat, WhatsApp, Telegram, and X. Social Media is also the largest contributor to upstream traffic on Mobile, due in large part to the sharing and posting of videos on apps like TikTok and Facebook Messenger.
- Despite the volumetric power of Social Media over Mobile, YouTube still comes out on top for overall per-sub volume, with 233 MB per sub, per day.
- File Sharing and File Delivery traffic is on the rise, with automatic phone back up and VPNs driving up Cloud Storage volumes in iCloud and Google Cloud. Upstream traffic is growing because of the increases in video and photo uploads to the cloud, as well as software updates, and greater numbers of smart and IoT devices communicating.
- Applications are becoming more complex, with more intricate blends of content within, as shown by the tables on page 18, of WhatsApp, Slack, Steam, and Xbox – apps that offer combinations of video, audio, live streaming, messaging, and gaming.
- In our regional phenomena across the Americas, Europe, and APAC, Video dominates downstream, regardless of whether a region has higher Mobile or Fixed penetration. Social Media traffic is high in Europe, whereas Device Gaming traffic is higher in APAC than other regions.
- Across all regions, On-demand Streaming exerts the greatest volumetric pressure, with YouTube as the frontrunner in App volume and Subscriber volume in all regions.

For context and insights around each of these phenomena, please check out the corresponding page numbers for more in-depth analysis and graphical representations in related tables

Sandvine 2024
Global Internet Phenomena Report

NEW METHODOLOGY

In this report, we've changed the format and the type of numbers we are publishing to more accurately and precisely reflect the phenomena of the ever-evolving application landscape. AppLogic's library of 2,500+ application signatures and 5,000 traffic signatures classify more than 95% of the traffic in networks worldwide, despite the transport layer advancements that increasingly obfuscate traffic, such as encryption and flow multiplexing, even allowing for classification within tunneled apps or private relays.

AppLogic's unparalleled Application Identification across 14 App Categories and 11 Content Classification Categories illuminate truths otherwise obscured in internet traffic.

For example, the granularity of 14 App Categories means "Video" as an App Category is now parsed into:

- "On-Demand Streaming," such as Netflix, YouTube, Amazon Prime, etc.
- "Television," such as Discovery Plus, Fox, HBO Max, Sky
- "Operator Content," like BT Sport, AT&T DirectTV, Verizon FiOS, Movistar+, Comcast Xfinity TV
- "Communication", like video embedded in Facebook Messenger, Snapchat, or Instagram.

Going deeper into AppLogic's 11 Content Categories means understanding the subcategories that drive volume. For example, in Video Apps, it's important to identify what is:

- Livestream
- On-Demand
- Video
- Video Call

Social Media, is another manifold App Category that AppLogic breaks into parts, such as:

- On-Demand Video, Messaging
- Video Call, Voice Call (as in apps like WhatsApp, Facebook, Instagram, or Twitter)
- Game Play (as in apps like Steam)

The data powering the report comes from a representative sample, derived from a pipeline of dozens of Sandvine customers reporting across tens of millions of Fixed and Mobile Network subscribers, globally. Data is anonymized and aggregated.

The raw data is per-day App Volume (upstream and downstream), associated subscriber counts, and total subscriber counts in either a Fixed Network (Cable, FTTX, FWA, xDSL), or a Mobile Network (3G/4G/5G).

Our sample of aggregated, anonymized data is interpreted for the first time through three visualizations:

- "App Volume per Subscriber" (daily volume for an app divided by the total number of subscribers).
- "App User Volume" (daily volume for an app divided by the number of subscribers using a particular app).
- "App Popularity Percentage" (percentage of the subscriber base that use a particular app on a particular day).

A "Subscriber" in a Fixed network is a household, including all members and devices using apps. The Subscriber may be connecting over wired or Wi-Fi connections – with the traffic carried over a Fixed internet service. In our "Popularity" calculations, that traffic counts as one subscriber.

In a Mobile network, a "Subscriber" is an individual mobile phone user. The same person could be in one or more Fixed households, and could be counted as a Mobile or a Fixed Subscriber if connecting over Wi-Fi elsewhere. In other words, the same person could be in one or more Fixed households, and could be counted as a Mobile subscriber if connecting to Wi-Fi in another location.

With this data-driven analysis, we intend to inform and improve decision-making around Operations Management, Capacity Planning, Fair Usage and Congestion, Cyber Threat Management, Video QoE, Gaming QoE, Usage-Based Services, and new monetization opportunities

App Categories

- Video
- Television
- Social Media
- Communication
- Conferencing
- Cloud Gaming
- Device Gaming
- Audio
- File Sharing
- VPN
- IoT
- Other Apps
- Infrastructure Protocols

App Content Categories

- Browsing
- File Delivery
- On-demand Streaming
- Live Streaming
- Voice Call
- Video Call
- Messaging
- Game Play
- VR
- Machine to Machine
- Other Content

Like our Cosmos, the Internet is a Vast, Expanding Universe

Peering into it, layer by layer, is the only way to understand how internet phenomena affect networks, customers, and costs.

Lyn Cantor
CEO Sandvine

If you've ever gotten a headache trying to grasp the size of our universe in astronomical units, light years, or parsecs, you'd probably need an aspirin when trying to understand the internet's size in giga-, exa-, peta-, or zettabytes.

Though it's possible to measure the expansion of the physical universe, it's more difficult to measure and quantify something as abstract as the Internet. Internet traffic is like Dark Matter, mysterious in both complexion and impact now that 95% of web traffic[1] is encrypted through HTTPS, ECH, and other encryption methods.

Much like the James Webb telescope goes beyond what the Hubble telescope has already done, AppLogic goes beyond Application and Network Intelligence to pierce the darkening web layer by layer, revealing what's actually happening over your networks.

AI-powered application classification and content categorization reveal average total volumes, app volumes, and per-subscriber app volumes at an application, content, and brand level. This is the industry's most granular identification and visualization of internet trends in downstream and upstream traffic over fixed and mobile networks.

With AppLogic, we can for the first time extrapolate that the average total usage across the world's 6.4 billion mobile subscriptions and 1.4 billion fixed connections is approximately **33 Exabytes** per day, with per-subscriber usage of about **4.2 GB** per day.

This is a baseline against which we can compare future findings, helping to determine if changes in the internet's bandwidth volume are due to usage trends by subscribers, or bigger file sizes.

In the upcoming tables and insights powered by AppLogic, you'll get an idea of what's driving today's volumes, and see what a single source of truth can look like for Planning, Operations and Big Data teams that make decisions about when and where to extend and improve existing infrastructure.

Why do internet phenomena matter more than ever?

It's no secret that digital innovation requires massive connectivity. Just last year during MWC Barcelona, Mark Zuckerberg remarked that "creating a true sense of presence in virtual worlds delivered to smart glasses and VR headsets will require massive advances in connectivity."

As he and other influential tech leaders develop new technologies, your "innovator" and "early-adopter" subscribers will become hungry for the applications that front end innovations like AI, AR/VR, metaverse, smart city, autonomous, and the IoT (as we illustrate on page 16).

This leaves you, the network operator, somewhat beholden to the decisions OTTs make and the data volumes they stimulate. This may feel like unjust enrichment, or a parasitic effect, with the world's most profitable companies accelerating demands for throughput and speed,

1. https://www.eff.org/deeplinks/2023/12/year-review-last-mile-encrypting-web
2. https://www.theverge.com/2023/9/18/23879475/netflix-squid-game-sk-broadband-partnership

contributing nothing to the infrastructure that fuels record-breaking profits.

Simultaneously, you are feeling mounting pressure to provide broadband equity and affordability to underserved rural and urban areas, where people remain socially and economically disadvantaged because of the Digital Divide.

To recover the enormous costs of extending and improving infrastructure for both the already connected and the still unconnected, you have to "be ready" for possible network arbitrage with app-specific electronic detail records that quantify the impact of distinct categories of application traffic on network costs.

Already there are examples of operators[2] that have used app-level insights to transform their positions in digital ecosystems, fostering collaborative and more symbiotic business models that deflect negative impacts on networks, customers, and costs.

With ongoing discussions about fair-contribution or fair-share financial models , and attempts to broaden the base of contributions to network infrastructure, this is the time to set up app-level insights and visualizations that will help you improve customer satisfaction, reduce churn, tame congestion, and establish a foundation for more innovative monetization and cost recovery.

As the maxim goes, "insanity is doing the same thing over and over again and expecting different results." Relying on Packet Gateway and probe data is not going to help you to know more about what's actually happening on your network. You should close the gaps current "good-enough" solutions leave open so you can peer into the darkening web and fully understand the outsized impact certain apps are having on your customers and networks.

We hope in these tables and in one-on-one meetings, you will see we're the only vendor that does content classification and QoE scoring. We can beat out any vendor on application classification, consistently scoring 95%+, compared to the industry average of 60%. That's critical now that encrypted traffic continues to grow, making it hard for you to see what's taking place on your networks.

With that said, let's begin our exploration with an examination of the internet's Digital Giants – brands responsible for the overwhelming majority of internet traffic volume around the world

> "Internet traffic is like Dark Matter – mysterious in both complexion and impact on network resources and App QoE"
>
> **Lyn Cantor, CEO, Sandvine**

Exploring the Internet's DIGITAL GIANTS

The top eight brands generate more internet traffic than everyone else combined.

We know the internet is home to billions of websites, clouds, databases, social networks, platforms, marketplaces, and multimedia files. We all experience this digital universe through a macrocosm of applications that, like stars, possess their own distinct features and capabilities. The biggest are the digital "supergiants" that generate the largest application volumes, more than all others combined – Meta, Apple, Microsoft, Amazon, Alphabet, and Netflix (MAMAAN).

As you'll see in the graph and Table 1 to the right, MAMAAN generates more than half of all internet traffic across Fixed and Mobile networks, nearly identical to the totals from our 2023 report.

What's new this year is that both TikTok and Disney+ now generate enough traffic that they appear in the top eight in our Top Brands tables. These two, plus MAMAAN, are responsible for a whopping 65% of all Fixed traffic.

We'd like to point out TikTok's meteoric rise, as it generates more traffic than all other providers, except Alphabet or Meta. As we show on page 13's App User Volume tables (which measure subscriber volume for people using a particular app at least once in a particular day), TikTok contributes about 173 MB of daily average volume on Mobile, with at least 36% of mobile users accessing the service in a day. Over Fixed, at least 64% of subscribers consume about 1.1 GB of volume for TikTok. We, therefore, extrapolate a weighted average across networks of about 692 MB, which is very similar to usage of Facebook, and in some cases, exceeds it.

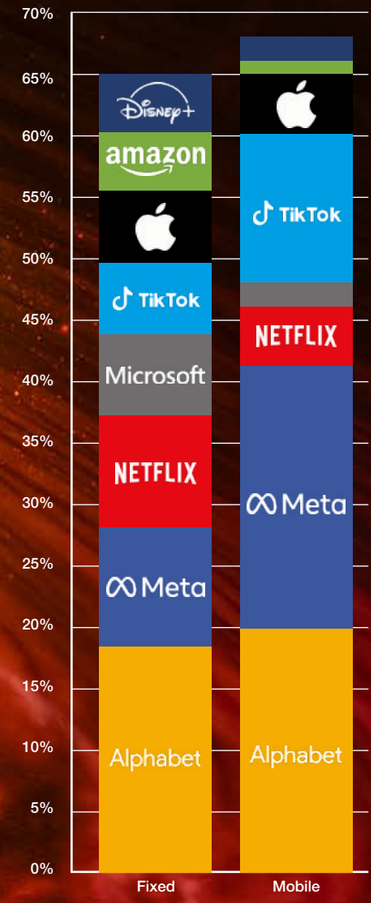
If we zoom in on Mobile networks, the dominance of the Top 8 is quite apparent, with MAMAAN accounting for more than half the volume. The factors behind these phenomena are varied, but we do see stark differences in how and when people are engaging with their apps over Fixed and Mobile networks.

We explore the factors driving these new consumption patterns in the next section, "Fixed and Mobile are Worlds Apart," on page 10

Table 1

	BRAND	Fixed	Mobile
1	Alphabet	18%	20%
2	Meta	11%	22%
3	Netflix	9%	5%
4	Microsoft	7%	2%
5	Tik Tok	6%	12%
6	Apple	6%	5%
7	Amazon	5%	1%
8	Disney	4%	2%
		66%	**69%**

Top Brands Contribution to Daily Volume: Fixed v. Mobile



SANDVINE The App QoE Company

Fixed and Mobile are Worlds Apart

When we drill into subscriber volumes, we notice that "Fixed is from Venus, Mobile is from Mars".

At first glance, downstream volumes are similar for both Fixed and Mobile; however, volume per user conveys a far different story. Fixed networks carry a deluge of On-Demand and Streaming video data from platforms like YouTube and Netflix, while Mobile networks see mostly shorter-form videos from social media-related apps like Facebook and TikTok. Subscribers are consuming large content over Fixed broadband and preserving their Mobile broadband for less bandwidth-intensive applications, like social media, messaging, and photos.

In the "Top App Categories – downstream Volume" for Fixed and Mobile, you'll see that Video accounts for nearly the same volume percentage (39% and 35%) on both networks, but at 5.7 GB per subscriber per day over Fixed, and 493 MB over Mobile, there's a huge difference. Fixed carries more than 10X the volume of per-user video than Mobile.

Where is the Fixed video volume coming from? We see in table 6 that YouTube and Netflix generate 1.9 GB and 1.4 GB, respectively, over Fixed.

As for Mobile volumes, 7 of the top 10 apps are in the Social Media category, namely: Facebook, TikTok, Instagram, Snapchat, WhatsApp, Telegram, and X. These apps are the top drivers of traffic volumes, averaging 558 MB per user per day, which exceeds even video volumes. Though YouTube holds the top spot for Mobile, it's the social media platforms that are driving per-sub app volumes.

If we look beyond just Video and Social, and combine the volumes of all the App Categories, we get a better sense of the volumes traversing Fixed and Mobile networks each day:

In the downstream for Fixed networks, the total volume across all applications is 14.5 GB per day. Further, if we combine both downstream and upstream volumes, we get a total volume of 15.7 GB per user, per day. Multiplied across 1.4 billion Fixed subscriptions globally, that amounts to 22 EB per day – or two-thirds of the total global internet traffic. That's significant, since Fixed networks account for only one-fifth of total internet connections worldwide.

To extrapolate for Mobile networks, we took the total volume for downstream and upstream traffic, which came to 1.7 GB per user, and multiplied that across the world's 6.4 billion mobile subscriptions, to get a total volume of 11 EB per day. Of that volume, On-Demand Streaming is by far the greatest contributor at 57% (or 900 MB per user, per day), due primarily to Social Media apps.

For an even closer look, we leveraged our new AppLogic analytics capabilities to create a "popularity percentage," which we describe in the next section, "Going Deeper with 'App User Volume'."

For a side-by-side comparison of downstream versus upstream subscriber volume and percentage volume, view "Downstream versus Upstream over Fixed and Mobile" on page 28

EVERY DAY
6.4 billion
mobile network
subscriptions generate
11 EB
of data traffic

EVERY DAY
1.4 billion
fixed network
subscriptions generate
22 EB
of data traffic

Table 2

Top App Categories by Downstream Volume – Fixed			
	Downstream Volume		
	Application	% DS Vol	Sub. Volume
1	Video	39%	5.7 GB
2	Social Media	18%	2.6 GB
3	Television	11%	1.6 GB
4	File Sharing	9%	1.3 GB
5	Device Gaming	7%	1.1 GB
6	General Web Apps	6%	889 MB
7	Communication	2%	249 MB
8	VPN	2%	234 MB
9	Audio	0.7%	98 MB
10	Conferencing	0.3%	47 MB
11	Cloud Gaming	0.07%	11 MB
12	IoT	0.03%	4 MB
13	Peer To Peer	0.03%	4 MB
14	Other Apps	5%	753 MB
			14.5 GB

Table 3

Top App Categories by Downstream Volume – Mobile			
	Downstream Volume		
	Application	% DS Vol	Sub. Volume
1	Social Media	35%	558 MB
2	Video	31%	493 MB
3	Device Gaming	7%	117 MB
4	File Sharing	7%	112 MB
5	General Web Apps	5%	72 MB
6	Communication	4%	57 MB
7	VPN	2%	28 MB
8	Television	1%	22 MB
9	Audio	0.9%	14 MB
10	Conferencing	0.2%	3 MB
11	Cloud Gaming	0.06%	885 KB
12	IoT	0.02%	238 KB
13	Peer To Peer	0.01%	132 KB
14	Other Apps	6%	98 MB
			1.6 GB

Table 4

Top Content Categories by Downstream Volume – Fixed			
	Downstream Volume		
	Content Category	% DS Vol	Sub. Volume
1	On-Demand Streaming	54%	7.9 GB
2	Live Streaming	14%	2.0 GB
3	File Delivery	13%	2.0 GB
4	Browsing	3%	441 MB
5	Game Play	3%	398 MB
6	Video Call	2%	300 MB
7	Messaging	0.6%	81 MB
8	Voice Call	0.5%	74 MB
9	Machine to Machine	0.01%	2 MB
10	AR/VR	0.00%	18 KB
11	Other	10%	1.4 GB

Table 5

Top Content Categories by Downstream Volume – Mobile			
	Downstream Volume		
	Content Category	% DS Vol	Sub. Volume
1	On-Demand Streaming	57%	900 MB
2	File Delivery	11%	173 MB
3	Live Streaming	7%	107 MB
4	Game Play	5%	75 MB
5	Video Call	5%	73 MB
6	Browsing	2%	38 MB
7	Messaging	2%	29 MB
8	Voice Call	1%	19 MB
9	Machine to Machine	0.00%	68 KB
10	AR/VR	0.00%	1 KB
11	Other	10%	160 MB

Table 6

Top Apps by Downstream Volume – Fixed			
	Downstream Volume		
	Application	% DS Vol	Sub. Volume
1	YouTube	16%	1.9 GB
2	Netflix	12%	1.4 GB
3	Facebook	9%	1.0 GB
4	Tik Tok	7%	859 MB
5	Operator Content	7%	850 MB
6	Amazon Prime	6%	722 MB
7	Disney+	5%	610 MB
8	Xbox Live	5%	573 MB
9	Instagram	3%	370 MB
10	Snapchat	2%	231 MB

Table 7

Top Apps by Downstream Volume – Mobile			
	Downstream Volume		
	Application	% DS Vol	Sub. Volume
1	YouTube	21%	233 MB
2	Facebook	18%	199 MB
3	Tik Tok	15%	175 MB
4	Instagram	7%	82 MB
5	Snapchat	7%	76 MB
6	Netflix	6%	73 MB
7	Disney+	2%	25 MB
8	WhatsApp	2%	24 MB
9	Telegram	1%	15 MB
10	X (Twitter)	1%	14 MB

Going Deeper with 'App User Volume'

To help operators identify new opportunities for app bundling, creation of new plans, and more creativity in monetizing network resources, "App User Volume" reflects how many subscribers are using a service at least once in a day, in the context of all active subscribers for an operator. This is an indicator of "popularity," and we break out the top 5 for each App Category in the tables on the right.

Some points of interest in the App User Volume tables include:

Social Media and Communication: Though separating Social Media traffic from Communication can be difficult, we are now able to make the distinction with AppLogic. "Communication" traffic includes video and photos that are embedded in apps like Facebook Messenger, Snapchat, and Instagram. We find in the data that Snapchat is very popular for instant messaging and sharing pictures, but also possesses an active Social Media component.

On the flip side, we see Social Media traffic can have within it messaging, video calls, and voice calls. In Table 8 you will see that TikTok can be used for messaging, though it's more commonly used for scrolling through content. In the table, you'll see that TikTok is used a little every day by 36% of mobile subs at 173 MB, whereas Instagram is used daily by 35% of mobile users, but with a daily app volume per user of 961 MB. Similarly, Facebook is used by 35% of mobile users daily, but only 190 MB per user, per day, suggesting a quick look and no real scrolling behavior.

Operator Content: For the first time, this category is showing up in the top five of Top Apps for the "Television" category. Feeling the heat from OTTs, operators are providing a value-add to improve customer perception and customer satisfaction, while also getting a portion of the revenues from the pipe they provide. Some examples of operator offerings include BT Sport, AT&T DirectTV, Verizon FiOS, Movistar+, Comcast Xfinity TV.

Audio Streaming: Looking at Fixed households, Spotify has a penetration of an impressive 49%, which means half of the households in our data generate Spotify traffic, compared to 32% for Apple Music and 5% for Amazon Music. On Mobile, Spotify generates 23% of all traffic, Apple Music 16%, and Amazon Music at 1%. That means that on any given day, people tend to listen to music in a household more than they do when "on the move." To give an idea of the impact, the average of 30 minutes of Spotify streaming each day correlates to about 72 MB.

Conferencing: In our data, we see that between Microsoft Teams and Zoom, Zoom is twice as popular as Teams, but daily app volume per subscriber for Teams is almost 3X that of Zoom. In our next report, we will be exploring if this is due to codecs or something behavioral, like more frequent camera use, or perhaps more sharing of content on the calls.

IoT: The number of connected IoT devices is projected to grow to about 29 billion globally by 2030[3], with a large number of those devices going into the smart home market. The global smart home market size is projected to grow from $93.98 Billion in 2023 to $338.28 Billion by 2030[4]. In our data, for fixed networks, we see 21% of households with Alexa traffic, vs just 2% for Google Nest.

Social Media: TikTok generates more traffic than any other provider, except Alphabet or Meta, with per-user, per-day volumes of 173 MB over Mobile, and 1.1 GB over Fixed, with a weighted average across networks of about 348 MB.

On Facebook, mobile users do a quick look, and not a lot of scrolling, whereas TikTok users do the contrary, with lots of scrolling but not a lot of messaging. Also, Snapchat is increasingly popular for instant messaging and sharing pictures, with an active social media component as well.

Gaming: As broadband speeds increase, and 5G becomes more pervasive, people will enjoy smoother and more responsive gaming experiences. This will continue to drive the popularity of both Device and Cloud gaming.

Device Gaming is very bandwidth hungry, consuming more than even Video (though in aggregate, the latter is bigger). As we explore further in "The Truth about Gaming," page 25, game streaming consumes more than streaming HD video.

Console games also consume considerable bandwidth, not only with actual game play, but also in-game downloads, patches and updates.

In comprehending these App User Volumes, we identify the Application Categories and Applications that are most popular in a network at any given moment, which helps operators gain a better understanding of their subscribers' data usage and the impact they have on network resources

Table 8

App Category and App	% of Users	User Volume
Social Media		
Facebook	35%	190 MB
Tik Tok	36%	173 MB
Instagram	35%	961 MB
Snapchat	25%	119 MB
X (Twitter)	16%	71 MB
Communication		
WhatsApp	34%	36 MB
Facebook Messenger	38%	28 MB
Telegram	7%	74 MB
Discord	2%	373 MB
FaceTime	8%	26 MB

3. https://www.statista.com/statistics/1183457/iot-connected-devices-worldwide/
4. https://www.fortunebusinessinsights.com/press-release/smart-home-market-9476

Top Apps in Category by App User Volume – Fixed

Table 9

App Category and App	% of Users	User Volume
Video		
YouTube	35%	2.5 GB
Netflix	30%	4.2 GB
Amazon Prime	26%	2.6 GB
Disney+	21%	2.4 GB
Hulu	6%	3.1 GB
Social Media		
Facebook	52%	1.2 GB
Tik Tok	64%	1.1 GB
Instagram	48%	522 MB
Snapchat	32%	404 MB
X (Twitter)	28%	131 MB
Device Gaming		
Playstation Downloads	9%	11.3 GB
Xbox Live	7%	14.1 GB
Steam	13%	2.5 GB
ROBLOX	8%	856 MB
Xbox Games	15%	1.6 GB
Television		
Operator Content	5%	9.3 GB
Discovery Plus	3%	2.3 GB
Peacock	6%	591 MB
Tubi TV	10%	371 MB
Pluto TV	9%	465 MB
Audio		
Spotify	46%	62 MB
Podcast Services	14%	110 MB
Apple Music	38%	43 MB
Amazon Music	6%	166 MB
SoundCloud	6%	23 MB
Cloud Gaming		
Xbox Cloud Gaming	1%	4.1 GB
GeForce Now	2%	1.0 GB
Playstation Now	6%	10 MB
Garena+	2%	29 MB
Shadow	1%	5.8 GB
Communication		
FaceTime	34%	150 MB
WhatsApp	40%	136 MB
Discord	8%	963 MB
Telegram	10%	245 MB
Facebook Messenger	49%	108 MB
Conferencing		
Microsoft Teams	3%	682 MB
Zoom	6%	253 MB
Google Meet	25%	7 MB
WebEx	2%	156 MB
Skype	1%	259 MB
IoT		
Nest	2%	52 MB
Amazon Alexa	21%	7 MB
EasyN Camera Service	2%	20 MB
Apple Siri	52%	283 KB
Arlo	2%	28 MB

Top Apps in Category by App User Volume – Mobile

Table 10

App Category and App	% of Users	User Volume
Video		
YouTube	23%	334 MB
Netflix	5%	1.1 GB
Disney+	3%	565 MB
XVIDEOS	6%	148 MB
Amazon Prime	2%	1.3 GB
Social Media		
Facebook	35%	190 MB
Tik Tok	36%	173 MB
Instagram	35%	961 MB
Snapchat	25%	119 MB
X (Twitter)	16%	71 MB
Device Gaming		
Playstation Downloads	1%	5.8 GB
Xbox Live	1%	8.6 GB
ROBLOX	2%	365 MB
PUBG	2%	383 MB
Epic Games	1%	217 MB
Television		
Sky	3%	244 MB
Operator Content	3%	28 MB
Apple TV+	1%	71 MB
Discovery Plus	2%	39 MB
Jawwy TV	1%	41 MB
Audio		
Spotify	19%	20 MB
Apple Music	11%	15 MB
Podcast Services	3%	53 MB
Amazon Music	1%	57 MB
SoundCloud	2%	16 MB
Cloud Gaming		
Garena+	2%	20 MB
GeForce Now	1%	431 MB
Xbox Cloud Gaming	1%	992 MB
Playstation Now	1%	3 MB
Tencent Game server	3%	703 KB
Communication		
WhatsApp	34%	36 MB
Facebook Messenger	38%	28 MB
Telegram	7%	74 MB
Discord	2%	373 MB
FaceTime	8%	26 MB
Conferencing		
Microsoft Teams	1%	202 MB
Zoom	1%	79 MB
Google Meet	13%	2 MB
Blackboard Collaborate	1%	78 MB
Skype	1%	102 MB
IoT		
Nest	1%	8 MB
Apple Siri	31%	99 KB
Amazon Alexa	2%	2 MB
EasyN Camera Service	1%	24 MB
Tesla	1%	26 MB

Upstream Traffic Matters More Than Ever

Traditionally, dimensioning of networks and estimating capacity have focused primarily on the downstream. But with more user-generated content, upstream traffic is becoming a force to consider when evaluating coverage and capacity, and how to optimize networks to deliver the App QoE subscribers expect.

Table 11

App Category and App	% of Users	User Volume
File Sharing		
Android Market	**82.7%**	**104 MB**
iTunes Store	**56.9%**	**196 MB**
iCloud	**53.9%**	**56 MB**
Windows Update	**31.1%**	**207 MB**
Xbox Live	**1.9%**	**8,638 MB**

In the tables to the right, you'll see that Fixed networks upstream traffic is more about file delivery, file sharing and video uploads, whereas Mobile upstream traffic is more about Social Media.

As you'll see in Tables 12, 14, and 16, the Top App Category on Fixed networks upstream traffic is File Sharing, with File Delivery and iCloud contributing the most to per-subscriber volume. That is in large part due to the default settings on iPhones for automatic backups to the Cloud which usually occur when people get to their home WiFi networks. The same is true for Androids, which explains why Google Cloud appears high on the list as well.

As to be expected, BitTorrent continues to appear as a significant factor, with a small number of users generating a lot of data. For example, Academia and Science are sectors that use BitTorrent, usually using VPNs to protect the sizable files being transmitted. There is also the illegal sharing of copyrighted content that continues through torrenting. That said, usage of BitTorrent might go down as people use the cloud and tap the content that is increasingly available through streaming services.

Another phenomena to keep an eye on is the emergence of Google in upstream traffic, in part because of the popularity of virtual assistants, voice assistants, and smart devices. We think these devices, as well as smart cars, AR/VR, Gaming, M2M, robots, surveillance cameras, cloud, and the IoT will continue to drive services that have equal requirements for upstream and downstream traffic over both Fixed and Mobile networks.

When it comes to Mobile networks, we see that Social Media is a big contributor to upstream traffic, as was the case in downstream (which we cover on page 10). Here, in Table 13, Social Media's contribution to upstream traffic is also evident. The story behind that can be found in Table 17, where you see TikTok, Facebook Messenger, Snapchat, YouTube, and Instagram are prominent.

In our customers' networks, the big story is TikTok, which creates the most upstream traffic per subscriber. In just a few years, TikTok has amassed more than 1 billion subscribers, globally[5]. It has become a key innovator, changing the mentality around the creation and sharing of user-generated short-form videos. Its growing community of creators and TikTok's mushrooming number of followers make it the fastest-growing social media platform ever[6]. Currently, TikTok's largest market is the United States, with approximately 150 million monthly active users, many of whom use the app every day, and in the case of younger people, use the app "almost constantly," as was found in a recent Pew study[7].

This success means TikTok has inspired behavioral and usage changes across all major social media platforms, with Instagram, Snapchat, and YouTube attempting to replicate its success. That's why in our data, there is a notable presence in upstream traffic of traffic from WhatsApp, Facebook Messenger, Instagram, and other Social Media platforms – all of which encourage video creation and uploads, as well as video calls, voice calls and even game play.

You'll also note in our tables that "Communication" is a category generating a lot of traffic, with video and photos embedded in apps like Facebook Messenger, Snapchat, and Instagram. FaceTime shows up in the No. 2 spot because subscribers not only make video calls, but also create audio and video messages they can leave if their FaceTime video calls go unanswered. That means more files will be uploaded and stored for call recipients to see or listen to "on demand."

Snapchat, Instagram and others are used for voice and video calling, and for watching videos and viewing content with others within the same call session. All seem to be moving toward not only mobile usage, but encouraging use on computers through web apps. It will be interesting to see how that affects traffic in the future

5. https://newsroom.tiktok.com/en-us/1-billion-people-on-tiktok
6. https://www.inc.com/jason-aten/tiktok-is-fastest-growing-social-media-network-ever-why-us-may-ban-it.html
7. https://www.pewresearch.org/internet/2023/12/11/teens-social-media-and-technology-2023/

Table 12

Top App Categories by Upstream Volume 2023 – Fixed			
	Upstream Volume		
	Application Category	**% US Vol**	**Sub. Volume**
1	File Sharing	**28%**	**319 MB**
2	Video	**13%**	**153 MB**
3	Communication	**12%**	**134 MB**
4	General Web Apps	**11%**	**128 MB**
5	Social Media	**9%**	**107 MB**
6	VPN	**5%**	**61 MB**
7	Device Gaming	**4%**	**52 MB**
8	Conferencing	**2%**	**27 MB**
9	Television	**2%**	**25 MB**
10	IoT	**1%**	**15 MB**
11	Peer To Peer	**0.3%**	**4 MB**
12	Audio	**0.3%**	**3 MB**
13	Cloud Gaming	**0.03%**	**312 KB**
14	Other Apps	**11%**	**125 MB**
			1.2 GB

Table 13

Top App Categories by Upstream Volume – Mobile			
	Upstream Volume		
	Application Category	**% US Vol**	**Sub. Volume**
1	Social Media	**23%**	**29 MB**
2	Communication	**16%**	**20 MB**
3	File Sharing	**15%**	**20 MB**
4	General Web Apps	**12%**	**16 MB**
5	Video	**10%**	**12 MB**
6	Device Gaming	**4%**	**5 MB**
7	VPN	**4%**	**5 MB**
8	Conferencing	**1%**	**1 MB**
9	Audio	**0.4%**	**509 KB**
10	Television	**0.3%**	**393 KB**
11	IoT	**0.2%**	**234 KB**
12	Cloud Gaming	**0.04%**	**54 KB**
13	Peer To Peer	**0.00%**	**3 KB**
14	Other Apps	**15%**	**19 MB**
			0.1 GB

Table 14

Top Content Categories by Upstream Volume – Fixed			
	Upstream Volume		
	Content Category	**% US Vol**	**Sub. Volume**
1	File Delivery	**29%**	**330 MB**
2	On-Demand Streaming	**19%**	**222 MB**
3	Browsing	**9%**	**99 MB**
4	Video Call	**7%**	**85 MB**
5	Live Streaming	**7%**	**85 MB**
6	Voice Call	**5%**	**62 MB**
7	Game Play	**3%**	**30 MB**
8	Messaging	**1%**	**17 MB**
9	Machine to Machine	**0.06%**	**731 KB**
10	AR/VR	**0.00%**	**2 KB**
11	Other	**19%**	**224 MB**

Table 15

Top Content Categories by Upstream Volume – Mobile			
	Upstream Volume		
	Content Category	**% US Vol**	**Sub. Volume**
1	On-Demand Streaming	**20%**	**26 MB**
2	File Delivery	**16%**	**21 MB**
3	Voice Call	**13%**	**17 MB**
4	Browsing	**8%**	**10 MB**
5	Live Streaming	**7%**	**9 MB**
6	Messaging	**5%**	**7 MB**
7	Video Call	**4%**	**5 MB**
8	Game Play	**3%**	**4 MB**
9	Machine to Machine	**0.03%**	**33 KB**
10	AR/VR	**0.00%**	**82 KB**
11	Other	**23%**	**29 MB**

Table 16

Top Apps by Upstream Volume – Fixed			
	Upstream Volume		
	Application	**% US Vol**	**Sub. Volume**
1	iCloud	**9%**	**101 MB**
2	FaceTime	**5%**	**56 MB**
3	Google Cloud Storage	**4%**	**47 MB**
4	Google	**4%**	**46 MB**
5	YouTube	**4%**	**46 MB**
6	BitTorrent	**4%**	**46 MB**
7	Tik Tok	**3%**	**40 MB**
8	Facebook	**3%**	**31 MB**
9	Discord	**2%**	**28 MB**
10	Amazon AWS	**2%**	**25 MB**

Table 17

Top Apps by Upstream Volume – Mobile			
	Upstream Volume		
	Application	**% US Vol**	**Sub. Volume**
1	Tik Tok	**8%**	**10 MB**
2	Facebook Messenger	**8%**	**10 MB**
3	Snapchat	**6%**	**7 MB**
4	Amazon AWS	**6%**	**7 MB**
5	YouTube	**5%**	**6 MB**
6	Facebook	**5%**	**6 MB**
7	iCloud	**5%**	**6 MB**
8	Google	**4%**	**5 MB**
9	WhatsApp	**4%**	**5 MB**
10	Instagram	**3%**	**4 MB**

App Complexity Requires Advanced Visualization and Visibility

Over the past few years, we've tracked the ways in which apps have continued to become more intricate and complex. Some, like Facebook, are becoming "super apps," characterized by complex mashups of capabilities and content within a single app.

With "app complexity" comes the need to better visualize traffic in order to truly grasp the content within the app and how that affects usage and ultimately network resources, and importantly, App QoE for customers.

This visualization is increasingly important as encryption obfuscates traffic, making it more difficult for operators to understand what is happening over their networks. Industry estimates around 95% of internet traffic is now encrypted, with around 85% of attacks encrypted[9].

To the right in Table 18, we analyze a Fixed Network's content within popular apps, showing the corresponding App User Volume per day, which is the average usage across all subscribers using the app in a day:

Here, we give examples of the daily content category contribution to different applications' volume. That's the average usage across all subscribers using a particular app in a single day.

In WhatsApp, most of the volume comes from the sharing of photos and files, with the rest generated by Voice and Video Calls, as well as some Messaging.

In Xbox Live, you'll see File Delivery volume is much greater than the actual "game play," which we talk about on page 25', "The Truth About Gaming."

In X (formerly, Twitter) traffic, per-day volume for Messaging content is smaller than of On-Demand and Live Streaming.

The same is true in SnapChat, where On-Demand Video is responsible for more volume per day than Messaging or Voice Calls.

What these tables convey is that there are multiple components of an app that can affect subscribers' App QoE. For example, messaging could work well, but poor voice quality, or frozen video calls, could lead to a bad user experience, and hence, a downgraded perception of the network's performance.

In another instance, a positive on-demand streaming experience could be tainted if a concurrent messaging session doesn't work, or vice versa.

By seeing the components and corresponding usage, it's more likely operators can understand the user's experience during each stage of an interaction or engagement with an app. That informs more proactive responses to head off any dissatisfaction or negative feelings toward the operator's brand

Table 18

Apps by Content Category Contribution in Daily Volume – Fixed

App and Content	Volume Per Day
WhatsApp	**112 MB**
Other	**68 MB**
Voice Call	**22 MB**
Video Call	**19 MB**
Messaging	**3 MB**
X (Twitter)	**15 MB**
On-Demand Streaming	**11 MB**
Live Streaming	**3 MB**
Messaging	**377 KB**
Other	**7 KB**
Xbox Live	**479 MB**
File Delivery	**446 MB**
Game Play	**30 MB**
Other	**2 MB**
Live Streaming	**71 KB**
Messaging	**1KB**
Steam	**145 MB**
Game Play	**100 MB**
Other	**44 MB**
Video Call	**0.09 KB**

Table 19

Apps by Content Category Contribution in Daily Volume – Mobile

App and Content	Volume Per Day
WhatsApp	**37 MB**
Other	**33 MB**
Voice Call	**2 MB**
Video Call	**1 MB**
Messaging	**1 MB**
X (Twitter)	**17 MB**
On-Demand Streaming	**11 MB**
Live Streaming	**3 MB**
Messaging	**2 MB**
SnapChat	**107 MB**
On-Demand Streaming	**91 MB**
Messaging	**10 MB**
Voice Call	**6 MB**

The Truth About Gaming

Which consumes more bandwidth – Video or Gaming?

As we show on page 13, video consumes the most bandwidth on the network in aggregate, but Device Gaming and Cloud Gaming are significantly more bandwidth hungry. In our Fixed network data, 15% of households have an Xbox. We estimate that at 50 Mbps, the data consumption in an hour would be 22 GB/hour – significantly more than HD streaming video consumes.

In console games, it's not only game play that consumes bandwidth, but also patches and in-game downloads. In our Fixed network data, 9% of households have PlayStation downloads on any given day, with an average daily volume for downloads at 11.3 GB. Compared to Netflix's average of 4.1 GB for roughly four hours of streaming, a gamer uses almost 3X the volume as a "Streamer".

Cloud gaming did not take off as quickly as anticipated because of ongoing latency and lag issues. But as these performance problems are resolved, gamers are discovering they can have an experience that is more comparable to what they get over their specialized consoles.

For example, as of late 2023, NVIDIA reported that GeForce NOW had more than 25 million users. Sandvine app user volume data (as shown on page 13), shows that in Fixed networks, roughly 2% of households have GeForce NOW traffic in a day. Each one of those households uses 874 MB, which, depending on bandwidth (25-50 Mbps), would amount to just 5-10 minutes of game play. That could really add up over the course of an hour or more of game play.

Microsoft's Xbox Cloud Gaming service has been used by more than 20 million people, or a popularity of 1%, with each subscriber averaging 4.1 GB of daily usage.

If projections by Fortune Business Insights are accurate, the global cloud gaming market will grow from $5.76 billion in 2023 to $84.97 billion by 2030[12], which could trigger a tremendous flood of data over Fixed and Mobile networks

15% of households have an Xbox each consuming up to 22 GB/hour FOR CLOUD GAMING

Table 44

App Category and App	% of Users	User Volume
Device Gaming		
Playstation Downloads	**9%**	**11.3 GB**
Xbox Live	**7%**	**14.1 GB**
Steam	**13%**	**2.5 GB**
ROBLOX	**8%**	**856 MB**
Xbox Games	**15%**	**1.6 GB**
Cloud Gaming		
Xbox Cloud Gaming	**1%**	**4.1 GB**
GeForce Now	**2%**	**1.0 GB**
Playstation Now	**6%**	**10 MB**
Garena+	**2%**	**29 MB**
Shadow	**1%**	**5.8 GB**

Regional Phenomena Americas, Europe, and APAC

Every geography has its own Mobile and Fixed Broadband landscape. Where some countries have a very high penetration of mobile phones, others have significant traction with both Fixed and Mobile.

This means that in some regions, operators' subscriber bases skew the data for application volumes. For example, there are some countries that have a big concentration of one OS over another, which means they have a disproportionate and skewed impact on global volumes.

In Japan, there is a closer division between iOS and Android, though Android has a slightly higher market share.

The same is true in bigger countries within Latin America, as well as Africa. For these reasons, Android has a higher penetration worldwide, giving Google Play Store more influence on the data generated by apps (2.56 million apps versus Apple's 1.85 million apps).

In the United States, which has a very large penetration of smartphones, iOS is the predominant operating system. Other countries with significant iOS presence include Canada, Australia, New Zealand, Denmark, Norway, and North Korea[10].

When we look at the Fixed broadband market, especially in terms of penetration and speed, there are certain countries that stand out. According to Ookla[11], some of the top countries for performance are the United Arab Emirates, South Korea. Malaysia, India, and the Dominican Republic. Worth noting is the median global 5G download speed, which Ookla says increased by 20% in Q3 2023, reaching 203.04 Mbps (compared to 168.27 Mbps in Q3 2022).

For these reasons, our regional total volume data may be skewed toward Mobile, and more heavily toward iOS than would be the case if we had data beyond the aggregate of our customers' subscribers.

With that in mind, we do want to point out some of the phenomena that caught our attention when comparing one region's data to the others. This will help you look for certain phenomena as you look at each region's tables:

- In all regions' downstream traffic, Video is the biggest traffic category for volume, with percentages ranging between 41% and 48%. In the Americas, Video makes up 48% of the volume, with most of that attributable to On-Demand Streaming, at approximately 5.6 GB per subscriber, which is comparable to APAC volume for video, but about double that of Europe.
- On-Demand Streaming exerts the greatest volumetric pressure, with YouTube as the frontrunner in App volume and subscriber volume across all geographies. In all regions, YouTube drives between 14-17% of the volume, but APAC has the greatest per-user volume at 2.5 GB (as compared to the second-highest, approximately 1.5 GB in the Americas).
- File Sharing is the leading factor in upstream traffic volumes, with iCloud showing up as the main driver. No doubt, iOS users are uploading a huge number of photos and videos, as well as subscribers sharing files and notes, which are then synced across all of the users' devices. File Sharing volume per sub is much greater in APAC than other regions, with 493 MB per user, driven by iCloud and PlayStation Downloads.

We also see higher per-sub volumes for Google and Google Cloud in APAC than other regions.

- In the Americas, BitTorrent generates the third-largest volume in the upstream traffic, but it is much smaller in Europe, and not showing up at all in APAC's top-10. BitTorrent is often used by more tech-savvy, heavy internet users such as those in Academia or Science, who also tend to use VPNs to protect their files.
- Social Media is a popular app category in Europe, whereas in APAC, Device Gaming is more popular, which pushes Xbox Live and PlayStation Downloads into the higher-tier of the volume rankings. Device Gaming is, however, showing up in the top 4 for all regional DL traffic.
- Netflix consistently appears in the top 3 in all regions, although in Europe, DAZN, a sports and entertainment streaming service, shows up in the rankings. Disney+ and TikTok show up across all regions

Interestingly, Operator Content appears in the top 10 for Americas and Europe. This is an important change as Operators have realized the change in the value chain and are now creating their own OTT offerings to be able to generate additional revenues.

10. https://worldpopulationreview.com/country-rankings/iphone-market-share-by-country
11. https://www.ookla.com/articles/worldwide-connectivity-mobile-fixed-networks-digital-divide-2023

Regional Phenomena Americas

Table 20

Top App Categories by Downstream Volume 2023 – Americas

	Downstream Volume		
	Application Category	**% DS Vol**	**Sub. Volume**
1	Video	48%	5.643 GB
2	Television	17%	1.978 GB
3	Social Media	10%	1.122 GB
4	Device Gaming	9%	1.086 GB
5	File Sharing	6%	726 MB
6	General Web Apps	3%	352 MB
7	VPN	1%	173 MB
8	Communication	1%	130 MB
9	Audio	0.9%	110 MB
10	Conferencing	0.3%	36 MB
11	Cloud Gaming	0.1%	13 MB
12	Peer To Peer	0.08%	9 MB
13	IoT	0.04%	5 MB
14	Other Apps	3%	405 MB

Table 21

Top App Categories by Upstream Volume 2023 – Americas

	Upstream Volume		
	Application Category	**% US Vol**	**Sub. Volume**
1	File Sharing	27%	205 MB
2	Communication	14%	101 MB
3	Video	11%	85 MB
4	General Web Apps	7%	54 MB
5	Social Media	6%	44 MB
6	VPN	4%	27 MB
7	Device Gaming	4%	27 MB
8	Television	3%	24 MB
9	IoT	3%	21 MB
10	Conferencing	3%	20 MB
11	Peer To Peer	1%	9 MB
12	Audio	0.4%	3 MB
13	Cloud Gaming	0.04%	323 KB
14	Other Apps	17%	129 MB

Table 22

Top Content Categories by Downstream Volume 2023 – Americas

	Downstream Volume		
	Content Category	**% DS Vol**	**Sub. Volume**
1	On-Demand Streaming	57%	6.671 GB
2	Live Streaming	18%	2.086 GB
3	File Delivery	11%	1.312 GB
4	Game Play	3%	322 MB
5	Browsing	3%	301 MB
6	Video Call	0.9%	108 MB
7	Voice Call	0.5%	58 MB
8	Messaging	0.3%	40 MB
9	Machine to Machine	0.02%	2 MB
10	AR/VR	0.00%	20 KB
11	Other	8%	887 MB

Table 23

Top Content Categories by Upstream Volume 2023 – Americas

	Upstream Volume		
	Content Category	**% US Vol**	**Sub. Volume**
1	File Delivery	27%	205 MB
2	On-Demand Streaming	15%	111 MB
3	Video Call	10%	74 MB
4	Live Streaming	9%	67 MB
5	Browsing	7%	50 MB
6	Voice Call	6%	43 MB
7	Game Play	2%	14 MB
8	Messaging	1%	8 MB
9	Machine to Machine	0.08%	632 KB
10	AR/VR	0.00%	3 KB
11	Other	24%	177 MB

Table 24

Top Apps by Downstream Volume 2023 – Americas

	Downstream Volume		
	Application	**% DS Vol**	**Sub. Volume**
1	YouTube	14%	1.477 GB
2	Amazon Prime	11%	1.219 GB
3	Netflix	11%	1.152 GB
4	Operator Content	9%	928 MB
5	Disney+	6%	646 MB
6	Facebook	4%	480 MB
7	Tik Tok	3%	353 MB
8	Xbox Live	3%	288 MB
9	Playstation Downloads	2%	270 MB
10	Discovery Plus	2%	228 MB

Table 25

Top Apps by Upstream Volume 2023 – Americas

	Upstream Volume		
	Application	**% US Vol**	**Sub. Volume**
1	iCloud	10%	60 MB
2	FaceTime	9%	56 MB
3	BitTorrent	8%	51 MB
4	YouTube	4%	26 MB
5	Google Cloud Storage	4%	24 MB
6	Nest	3%	20 MB
7	Discord	3%	18 MB
8	Facebook	3%	17 MB
9	Google	3%	15 MB
10	Amazon Prime	2%	14 MB

Regional Phenomena Europe

Table 26

Top App Categories by Downstream Volume 2023 – Europe

	Downstream Volume		
	Application Category	% DS Vol	Sub. Volume
1	Video	49%	2.847 GB
2	Social Media	14%	799 MB
3	File Sharing	9%	561 MB
4	Device Gaming	7%	414 MB
5	Television	5%	274 MB
6	General Web Apps	3%	168 MB
7	Communication	2%	92 MB
8	VPN	0.7%	38 MB
9	Audio	0.5%	27 MB
10	Conferencing	0.2%	9 MB
11	Cloud Gaming	0.1%	6 MB
12	IoT	0.01%	1 MB
13	Peer To Peer	0.01%	1 MB
14	Other Apps	10%	536 MB

Table 27

Top App Categories by Upstream Volume 2023 – Europe

	Upstream Volume		
	Application Category	% US Vol	Sub. Volume
1	File Sharing	28%	111 MB
2	Video	20%	80 MB
3	Communication	10%	39 MB
4	General Web Apps	7%	29 MB
5	Social Media	7%	29 MB
6	Device Gaming	5%	19 MB
7	Television	2%	9 MB
8	VPN	2%	9 MB
9	Conferencing	1%	5 MB
10	Audio	0.3%	1 MB
11	IoT	0.1%	439 KB
12	Peer To Peer	0.07%	290 KB
13	Cloud Gaming	0.02%	93 KB
14	Other Apps	15%	59 MB

Table 28

Top Content Categories by Downstream Volume 2023 – Europe

	Downstream Volume		
	Content Category	% DS Vol	Sub. Volume
1	On-Demand Streaming	63%	3.664 GB
2	File Delivery	13%	744 MB
3	Live Streaming	5%	300 MB
4	Game Play	5%	264 MB
5	Browsing	2%	100 MB
6	Messaging	0.7%	39 MB
7	Voice Call	0.4%	23 MB
8	Video Call	0.3%	16 MB
9	Machine to Machine	0.01%	315 KB
10	AR/VR	NA	NA
11	Other	11%	623 MB

Table 29

Top Content Categories by Upstream Volume 2023 – Europe

	Upstream Volume		
	Content Category	% US Vol	Sub. Volume
1	File Delivery	29%	115 MB
2	On-Demand Streaming	28%	110 MB
3	Browsing	6%	22 MB
4	Voice Call	5%	20 MB
5	Game Play	3%	14 MB
6	Live Streaming	3%	13 MB
7	Video Call	3%	11 MB
8	Messaging	1%	5 MB
9	Machine to Machine	0.03%	116 KB
10	AR/VR	NA	NA
11	Other	21%	82 MB

Table 30

Top Apps by Downstream Volume 2023 – Europe

	Downstream Volume		
	Application	% DS Vol	Sub. Volume
1	YouTube	15%	699 MB
2	Netflix	15%	682 MB
3	DAZN	7%	331 MB
4	Tik Tok	6%	289 MB
5	Facebook	6%	269 MB
6	Operator Content	5%	235 MB
7	Playstation Downloads	5%	223 MB
8	Instagram	5%	221 MB
9	Disney+	4%	181 MB
10	Amazon Prime	4%	176 MB

Table 31

Top Apps by Upstream Volume 2023 – Europe

	Upstream Volume		
	Application	% US Vol	Sub. Volume
1	iCloud	11%	35 MB
2	YouTube	8%	24 MB
3	WhatsApp	5%	17 MB
4	Netflix	5%	15 MB
5	BitTorrent	5%	15 MB
6	Google Cloud Storage	4%	14 MB
7	Tik Tok	4%	14 MB
8	Google Photos	4%	12 MB
9	DAZN	3%	9 MB
10	Instagram	2%	8 MB

Regional Phenomena APAC

Table 38

Top App Categories by Downstream Volume 2023 – APAC

	Downstream Volume		
	Application Category	% DS Vol	Sub. Volume
1	Video	41%	6.943 GB
2	Device Gaming	17%	2.917 GB
3	Social Media	15%	2.540 GB
4	File Sharing	11%	1.912 GB
5	General Web Apps	4%	619 MB
6	Television	3%	430 MB
7	Communication	2%	321 MB
8	VPN	1%	229 MB
9	Audio	0.8%	130 MB
10	Conferencing	0.4%	68 MB
11	IoT	0.03%	5 MB
12	Cloud Gaming	0.02%	3 MB
13	Peer To Peer	0.01%	1 MB
14	Other Apps	5%	819 MB

Table 39

Top App Categories by Upstream Volume 2023 – APAC

	Upstream Volume		
	Application Category	% US Vol	Sub. Volume
1	File Sharing	32%	493 MB
2	Video	16%	248 MB
3	Device Gaming	11%	179 MB
4	Communication	11%	169 MB
5	Social Media	9%	146 MB
6	General Web Apps	8%	127 MB
7	VPN	3%	44 MB
8	Conferencing	3%	41 MB
9	Television	1%	17 MB
10	Audio	0.5%	7 MB
11	IoT	0.4%	6 MB
12	Cloud Gaming	0.02%	317 KB
13	Peer To Peer	0.00%	65 KB
14	Other Apps	5%	81 MB

Table 40

Top Content Categories by Downstream Volume 2023 – APAC

	Downstream Volume		
	Content Category	% DS Vol	Sub. Volume
1	On-Demand Streaming	54%	9.063 GB
2	File Delivery	23%	3.829 GB
3	Live Streaming	9%	1.495 GB
4	Game Play	5%	918 MB
5	Browsing	3%	547 MB
6	Video Call	1%	193 MB
7	Messaging	0.8%	128 MB
8	Voice Call	0.5%	91 MB
9	Machine to Machine	0.01%	2 MB
10	AR/VR		
11	Other	4%	672 MB

Table 41

Top Content Categories by Upstream Volume 2023 – APAC

	Upstream Volume		
	Content Category	% US Vol	Sub. Volume
1	File Delivery	37%	569 MB
2	On-Demand Streaming	21%	320 MB
3	Browsing	7%	112 MB
4	Live Streaming	7%	111 MB
5	Video Call	7%	101 MB
6	Voice Call	4%	68 MB
7	Game Play	4%	61 MB
8	Messaging	2%	39 MB
9	Machine to Machine	0.02%	369 KB
10	AR/VR		
11	Other	11%	177 MB

Table 42

Top Apps by Downstream Volume 2023 – APAC

	Downstream Volume		
	Application	% DS Vol	Sub. Volume
1	YouTube	16%	2.488 GB
2	Netflix	14%	2.231 GB
3	Facebook	8%	1.309 GB
4	Xbox Live	8%	1.220 GB
5	Playstation Downloads	8%	1.215 GB
6	Disney+	6%	874 MB
7	Tik Tok	5%	749 MB
8	iTunes Store	2%	391 MB
9	Amazon Prime	2%	388 MB
10	Instagram	2%	340 MB

Table 43

Top Apps by Upstream Volume 2023 – APAC

	Upstream Volume		
	Application	% US Vol	Sub. Volume
1	iCloud	11%	159 MB
2	Playstation Downloads	6%	84 MB
3	YouTube	5%	78 MB
4	Facebook	5%	74 MB
5	Netflix	5%	65 MB
6	Xbox Live	4%	56 MB
7	Google	4%	55 MB
8	FaceTime	4%	51 MB
9	Google Cloud Storage	3%	49 MB
10	Google Photos	3%	44 MB

Conclusion: Why Internet Phenomena Matter

We started this year's Report acknowledging that the internet is a phenomenon that is difficult to quantify or measure. We are the first to attempt an extrapolation of its "size" across Fixed and Mobile networks. As Sandvine CEO, Lyn Cantor explained in his intro on page 6, we did this by multiplying an average per-sub, per-day volume of 4.2 GB across 6.4 billion Mobile subscriptions and 1.4 billion Fixed connections, bringing the total volume of internet traffic to approximately 33 Exabytes (EB) per day.

We didn't stop there, as every subscriber, every person, experiences the digital universe in very individual ways, through their own collection of applications. In our AppLogic tables and insights, we convey how different types of engagement across applications affect downstream and upstream traffic, and hence, network resources.

The enhanced AI-driven observability of AppLogic reveals whether traffic is generated by Video, Social Media, Communications, File Sharing or other categories of apps, and which content within those apps is shaping the volume and impact of apps on internet traffic. We see the dynamics of traffic differ among On-Demand Streaming, Live Streaming, Game Play, Video Calls, Messaging, and other types of content.

With this new baseline of data, we will be able to detect ongoing trends in per-subscriber App Volume; App User Volume; and App Popularity. For example:

- Will there be an increase or decline in the 4.2 GB per day per user, per day volume? If so, can we impart whether it's attributable mostly to Streaming Video, or some other category that may rise in the ranks, like Gaming, AR/VR, or M2M Communications?
- Will the average Video consumption per user change from the current 1.4 GB of video per day, and what will contribute to that change, such as video embedded in Social Media, in Communications, Video Calls, Streaming TV, Operator Content, or something else?
- Will Social Media Content continue to grow in popularity over Mobile networks, and what will be the nature of that content?
- What changes will we see in upstream traffic, with more content creators uploading videos, more smart devices coming online, more frequent and sizable gaming updates, and greater numbers of photos and videos uploaded to the cloud?
- As the world gets more connected, and the Digital Divide closes, what phenomena and trends will emerge?

To answer these questions, we will continue growing our library of application signatures and traffic signatures. Our goal is to keep up with transport layer advancements that obfuscate traffic, and subsequently, to improve AppLogic's Application Classification and Content Categorization.

We strive to remain the gold standard in AppQoE-focused analytics, empowering operators around the world with data-driven analyses that prepare them to "be ready" for what's to come in new business models, and possible network arbitrage with some of the world's biggest generators of internet traffic.

That means we will continually evolve and improve to keep up with changes in internet phenomena so that our customers can stay a step ahead of customer expectations, while also reducing costs and building sustainable business models

SANDVINE The App QoE Company

Visit www.sandvine.com **and read our blog at** www.sandvine.com/blog **to learn more about our App QoE portfolio.**

Resources

See our Resources page for a wide range of videos, webinars, and whitepapers:
www.sandvine.com/resources

Downstream versus Upstream over Fixed and Mobile

Top App Categories by Downstream Volume 2023 Fixed

	Downstream Volume		
	Application	**% DS Vol**	**Sub. Volume**
1	Video	39%	5.7 GB
2	Social Media	18%	2.6 GB
3	Television	11%	1.6 GB
4	File Sharing	9%	1.3 GB
5	Device Gaming	7%	1.1 GB
6	General Web Apps	6%	889 MB
7	Communication	2%	249 MB
8	VPN	2%	234 MB
9	Audio	0.7%	98 MB
10	Conferencing	0.3%	47 MB
11	Cloud Gaming	0.07%	11 MB
12	IoT	0.03%	4 MB
13	Peer To Peer	0.03%	4 MB
14	Other Apps	5%	753 MB
			14.5 GB

Top App Categories by Upstream Volume 2023 Fixed

	Upstream Volume		
	Application	**% US Vol**	**Sub. Volume**
1	File Sharing	28%	319 MB
2	Video	13%	153 MB
3	Communication	12%	134 MB
4	General Web Apps	11%	128 MB
5	Social Media	9%	107 MB
6	VPN	5%	61 MB
7	Device Gaming	4%	52 MB
8	Conferencing	2%	27 MB
9	Television	2%	25 MB
10	IoT	1%	15 MB
11	Peer To Peer	0.3%	4 MB
12	Audio	0.3%	3 MB
13	Cloud Gaming	0.03%	312 KB
14	Other Apps	11%	125 MB
			1.2 GB

Top Content Categories by Downstream Volume 2023 Fixed

	Downstream Volume		
	Application	**% DS Vol**	**Sub. Volume**
1	On-Demand Streaming	54%	7.9 GB
2	Live Streaming	14%	2.0 GB
3	File Delivery	13%	2.0 GB
4	Browsing	3%	441 MB
5	Game Play	3%	398 MB
6	Video Call	2%	300 MB
7	Messaging	0.6%	81 MB
8	Voice Call	0.5%	74 MB
9	Machine to Machine	0.01%	2 MB
10	AR/VR	0.00%	18 KB
11	Other	10%	1.4 GB

Top Content Categories by Upstream Volume 2023 Fixed

	Upstream Volume		
	Application	**% US Vol**	**Sub. Volume**
1	File Delivery	29%	330 MB
2	On-Demand Streaming	19%	222 MB
3	Browsing	9%	99 MB
4	Video Call	7%	85 MB
5	Live Streaming	7%	85 MB
6	Voice Call	5%	62 MB
7	Game Play	3%	30 MB
8	Messaging	1%	17 MB
9	Machine to Machine	0.06%	731 KB
10	AR/VR	0.00%	2 KB
11	Other	19%	224 MB

Top Apps by Downstream Volume 2023 Fixed

	Downstream Volume		
	Application	**% DS Vol**	**Sub. Volume**
1	YouTube	16%	1.9 GB
2	Netflix	12%	1.4 GB
3	Facebook	9%	1.0 GB
4	Tik Tok	7%	859 MB
5	Operator Content	7%	850 MB
6	Amazon Prime	6%	722 MB
7	Disney+	5%	610 MB
8	Xbox Live	5%	573 MB
9	Instagram	3%	370 MB
10	Snapchat	2%	231 MB

Top Apps by Upstream Volume 2023 Fixed

	Upstream Volume		
	Application	**% US Vol**	**Sub. Volume**
1	iCloud	9%	101 MB
2	FaceTime	5%	56 MB
3	Google Cloud Storage	4%	47 MB
4	Google	4%	46 MB
5	YouTube	4%	46 MB
6	BitTorrent	4%	46 MB
7	Tik Tok	3%	40 MB
8	Facebook	3%	31 MB
9	Discord	2%	28 MB
10	Amazon AWS	2%	25 MB

Top App Categories by Downstream Volume 2023 Mobile

	Downstream Volume		
	Application	**% DS Vol**	**Sub. Volume**
1	Social Media	35%	558 MB
2	Video	31%	493 MB
3	Device Gaming	7%	117 MB
4	File Sharing	7%	112 MB
5	General Web Apps	5%	72 MB
6	Communication	4%	57 MB
7	VPN	2%	28 MB
8	Television	1%	22 MB
9	Audio	0.9%	14 MB
10	Conferencing	0.2%	3 MB
11	Cloud Gaming	0.06%	885 KB
12	IoT	0.02%	238 KB
13	Peer To Peer	0.01%	132 KB
14	Other Apps	6%	98 MB
			1.6 GB

Top App Categories by Upstream Volume 2023 Mobile

	Upstream Volume		
	Application	**% US Vol**	**Sub. Volume**
1	Social Media	23%	29 MB
2	Communication	16%	20 MB
3	File Sharing	15%	20 MB
4	General Web Apps	12%	16 MB
5	Video	10%	12 MB
6	Device Gaming	4%	5 MB
7	VPN	4%	5 MB
8	Conferencing	1%	1 MB
9	Audio	0.4%	509 KB
10	Television	0.3%	393 KB
11	IoT	0.2%	234 KB
12	Cloud Gaming	0.04%	54 KB
13	Peer To Peer	0.00%	3 KB
14	Other Apps	15%	19 MB
			0.1 GB

Top Content Categories by Downstream Volume 2023 Mobile

	Downstream Volume		
	Application	**% DS Vol**	**Sub. Volume**
1	On-Demand Streaming	57%	900 MB
2	Live Streaming	11%	173 MB
3	File Delivery	7%	107 MB
4	Browsing	5%	75 MB
5	Game Play	5%	73 MB
6	Video Call	2%	38 MB
7	Messaging	2%	29 MB
8	Voice Call	1%	19 MB
9	Machine to Machine	0.00%	68 KB
10	AR/VR	0.00%	1 KB
11	Other	10%	160 MB

Top Content Categories by Upstream Volume 2023 Mobile

	Upstream Volume		
	Application	**% US Vol**	**Sub. Volume**
1	On-Demand Streaming	20%	26 MB
2	File Delivery	16%	21 MB
3	Voice Call	13%	17 MB
4	Browsing	8%	10 MB
5	Live Streaming	7%	9 MB
6	Messaging	5%	7 MB
7	Video Call	4%	5 MB
8	Game Play	3%	4 MB
9	Machine to Machine	0.03%	33 KB
10	AR/VR	0.00%	82
11	Other	23%	29 MB

Top Apps by Downstream Volume 2023 Mobile

	Downstream Volume		
	Application	**% DS Vol**	**Sub. Volume**
1	YouTube	21%	233 MB
2	Facebook	18%	199 MB
3	Tik Tok	15%	175 MB
4	Instagram	7%	82 MB
5	Snapchat	7%	76 MB
6	Netflix	6%	73 MB
7	Disney+	2%	25 MB
8	WhatsApp	2%	24 MB
9	Telegram	1%	15 MB
10	X (Twitter)	1%	14 MB

Top Apps by Upstream Volume 2023 Mobile

	Upstream Volume		
	Application	**% US Vol**	**Sub. Volume**
1	Tik Tok	8%	10 MB
2	Facebook Messenger	8%	10 MB
3	Snapchat	6%	7 MB
4	Amazon AWS	6%	7 MB
5	YouTube	5%	6 MB
6	Facebook	5%	6 MB
7	iCloud	5%	6 MB
8	Google	4%	5 MB
9	WhatsApp	4%	5 MB
10	Instagram	3%	4 MB

If you are not getting these types of insights about your customers' application consumption on your network, don't you think you should? Engage with us and we can show you how AppLogic turns confusion into clarity to help your business.

Lyn Cantor, CEO, Sandvine

For more information visit **https://www.sandvine.com** or follow Sandvine on Twitter **@Sandvine**.

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