The Evolution of Broadband Traffic: A Forecast for the Americas, EMEA, and APAC Regions

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Executive Summary

The global pandemic has underlined the critical role of broadband services, equating their necessity to that of utilities such as electricity, water and natural gas. With a marked increase in remote working, online education, and digital entertainment, broadband networks are facing unprecedented traffic growth. This paper investigates the evolving trends and forecasts aggregation network traffic across the Americas, EMEA, and APAC regions for the next five years. Video entertainment and emerging augmented/virtual reality (AR/VR) devices such as the Apple Vision Pro are key drivers of broadband demand and this paper analyzes application traffic distributions and video resolution data rates to predict future demands on aggregation networks. We expect video and other VR devices will primarily drive traffic in rural and metro aggregation networks. Core national and international networks typically carry less video traffic because it is typically cached in regional data centers.

Our methodology incorporates a granular analysis of household video consumption, accounting for the variety of resolutions and the average number of video streams per household. One of the techniques to reduce aggregation bandwidth for video content is to deploy edge caches to store locally the most heavily requested content from users. This has been incorporated into the model with the application of a 30% video caching rate, forming the basis of our traffic projection. Under the assumptions of a typical aggregation network servicing 20,000 households with a 75% maximum utilization rate, we present a regional analysis of expected traffic loads and necessary network capacity expansions.

Our analysis shows that aggregation network capacity requirements will grow from 100Gbps in 2023 to 400 Gbps in 2027 in the Americas, EMEA, and APAC.

Introduction

Consumers throughout the world have recognized since the pandemic struck in 2020 that scalable broadband service is not a luxury service but an essential service, like electricity. Broadband has been essential for both work and learning from home, but also for streaming video entertainment provided by devices such as smart TVs, Apple TV, Roku, and Amazon Fire TV. Broadband use also extends to a diverse mix of network connected devices such as laptops, smartphones, tablets, gaming consoles, security cameras, IoT devices and smart TVs. The increased versatility and use of broadband are driving tremendous growth in global internet traffic.

These resulting residential bandwidth growth and usage patterns have different effects on service providers' last-mile and aggregation networks. Household fixed broadband and video services must provide adequate bandwidth to support the simultaneous use of connected devices for the entire household. The role of the aggregation network is to ensure that there is adequate bandwidth to support bandwidth intensive real-time applications like video streaming and video meetings. The growth in video traffic has the potential to drive massive increases in the required bandwidth capacity of the aggregation network. Similar traffic volume hikes are not expected to impact the long-haul network as severely because most video traffic does not traverse the national core IP networks. Regional network operators and content providers are dispersing caches, cloud data centers, and video serving offices down to and within metro areas to reduce costly long-haul traffic requirements.

Methodology

The cornerstone of our approach to forecasting network traffic is the recognition that video streaming is the primary driver of data consumption in the future while emerging AR/VR devices, such as the Apple Vision Pro, will also impact network traffic growth. We have modeled emerging devices such as AR/VR and 8K video streaming in a single category together. The global growth rate of video was measured at 24% annually in the 2023 Sandvine report on global internet traffic . The Sandvine report also provides a breakdown of application traffic as depicted in Table 1. In order to forecast network traffic per household over five years, we begin by projecting the growth of video and VR traffic per household and then use the application traffic distributions in Table 1 to project the total network traffic per household in each region.

[1] https://www.sandvine.com/global-internet-phenomena-report-2023

Category	Americas	APAC	EMEA
Video/VR	73.74%	66.11%	62.46%
Gaming	5.77%	7.33%	3.01%
Marketplace	4.19%	7.19%	4.20%
Social Networking	3.77%	3.30%	14.22%
Cloud	3.52%	5.11%	2.58%
Web Browsing	3.34%	2.90%	4.38%
Messaging	2.48%	2.25%	4.94%
File Sharing	1.43%	3.37%	2.59%
Audio	0.92%	0.80%	0.30%
VPN	0.83%	1.62%	1.33%

Table 1. Distribution of Network Applications in Each Region

We begin with an analysis of the distribution of video resolutions within households across different regions. This distribution is essential to calculate the range of data rates that underpin our forecast. In the Americas, APAC, and EMEA, the prevalence of various video resolutions—from 480p to the data-intensive 8K—provides a granular view of current consumption patterns. The average video data rate, therefore, is derived from the weighted contribution of each resolution tier within the regional mix. A weight average of video traffic per household is calculated using an average mix of video resolutions and data rates as presented in Table 2.

Video Data Rates	Mbps	Americas	APAC	EMEA
720p	1.55	10%	10%	10%
1080p	2.20	30%	40%	35%
4K	6.66	47%	41%	44%
8K/(AR/VR)	15.50	12%	8%	10%
Average Video Data Rate	32.00	1%	1%	1%
		6.1	5.3	5.7

Table 2. Weighted Distribution of Video Data Rates in an Average Household for Each Region

We account for the number of simultaneous video streams per household, which is measured in the Sandvine report at 1.5 average streams per household. We multiply the average video rates specified in Table 2 by 1.5 to find the average video traffic per household during the prime-time busy period. The next factor to consider when calculating average traffic in the aggregation network is the level of video caching. In some networks, edge caches are centrally located, which results in all video traffic carried over the aggregation network. In other networks, edge caches are more distributed, which reduces the video traffic in the aggregation network. These architectures can vary depending on the service provider and the regions covered by the network. In some cases, there is no caching at the edge of the aggregation network and in other cases as much as 70% of video could be cached. We assume the average video cached at the edge of the network is 30%, which has the effect of reducing video aggregation network traffic by 30%.

Network Implications

We use the projections for average traffic per household to forecast network traffic and capacity requirements over five years. We focus primarily of aggregation networks in rural or exurban areas, which generally have large middle-mile/aggregation rings. To forecast network traffic and capacity, we use the following assumptions for each region:

- 20,000 households are passed by a typical aggregation network
- Aggregation networks use ring topologies
- The maximum utilization rate of the aggregation network is 75%

The other factor considered in projecting the total aggregation network traffic is the penetration rate of the total addressable market in the region covered by the aggregation network. Assuming a total addressable market of 20,000 households, the number of households served by the aggregation network is presented in Table 3.

	2023	2024	2025	2026	2027
Penetration Rate	25%	35%	45%	55%	60%
Total Households Served	5,000	7,000	9,000	11,000	12,000

Table 3. Penetration Rate and Total Households Served by the Regional Aggregation Network

Traffic per household is projected using the methodology described in this paper. The busy period aggregation network traffic is calculated by multiplying the average traffic per household by the total number of households served, which is calculated in Table 3. The aggregation network capacity requirements are calculated using the assumption that the maximum network utilization is 75%, and the ring capacity is in increments of 100Gbps. The results for each region are presented in the following sections of this paper.

Americas Regional Traffic and Capacity Forecast

The forecast for traffic per household, aggregation network traffic, and network capacity requirements are presented in Figures 1, 2, and 3, respectively.

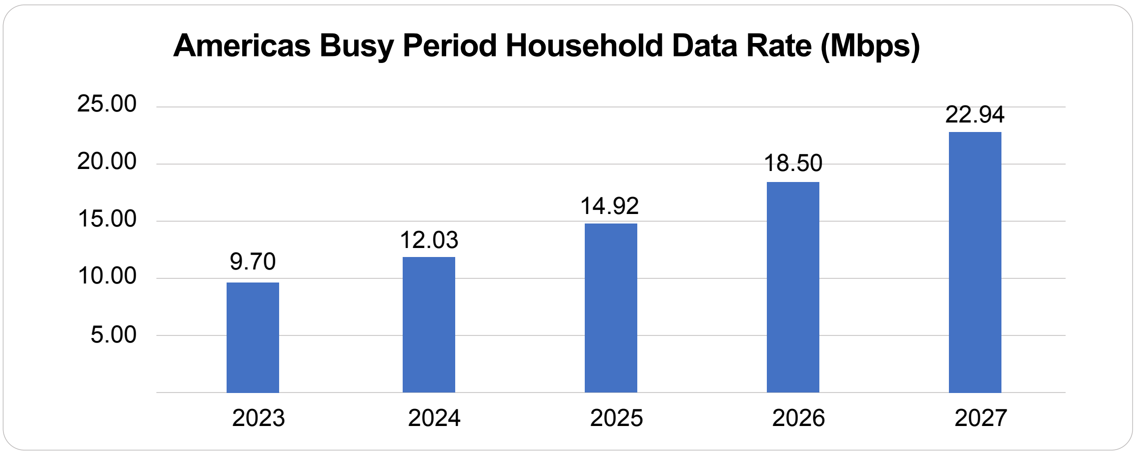

Figure 1. Americas Forecast of Average Household Data Rates during the Busy Period (Prime Time)

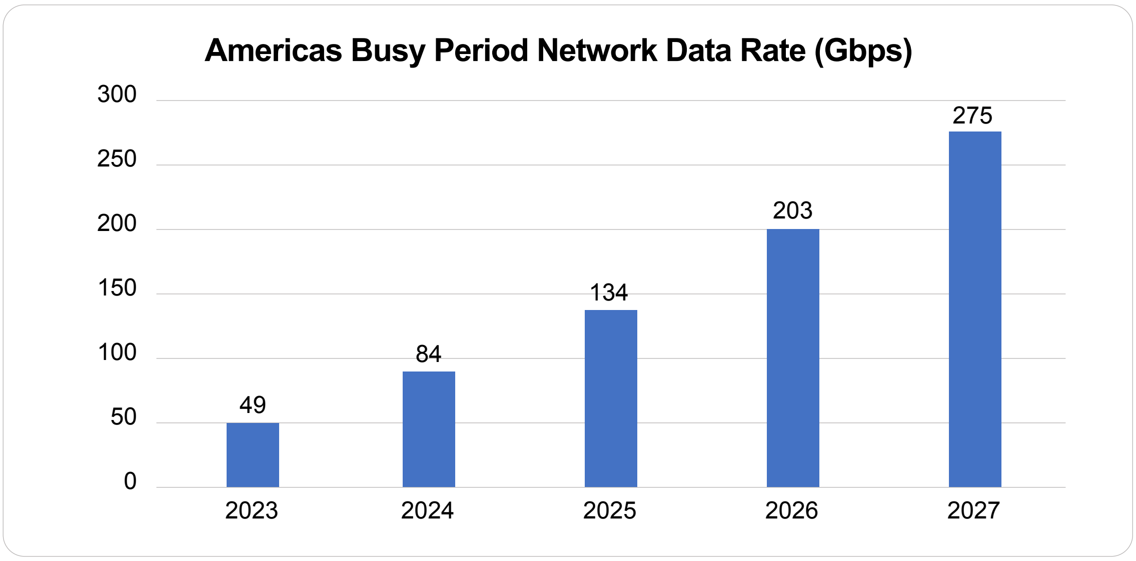

Figure 2. Americas Forecast of Average Aggregation Network Traffic during the Busy Period

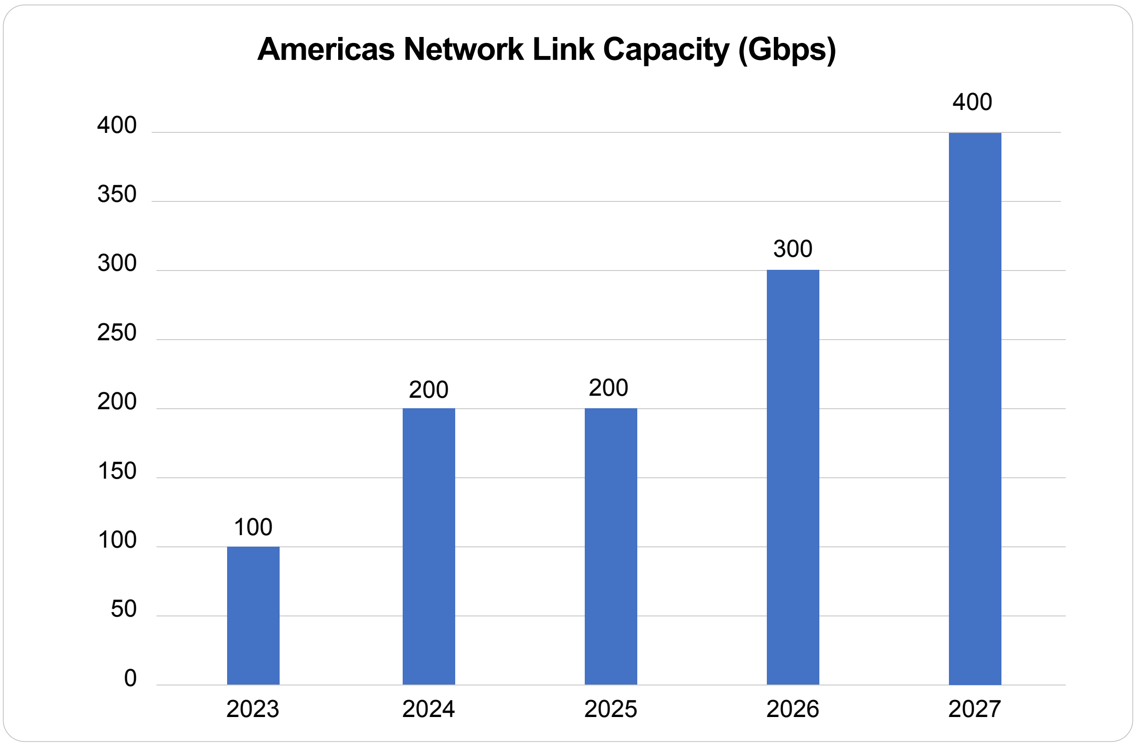

Figure 3. Americas Forecast of Network Capacity Requirements Assuming Maximum Network Utilization of 75%

EMEA Regional Traffic and Capacity Forecast

The forecast for traffic per household, aggregation network traffic, and network capacity requirements are presented in Figure 4, Figure 5, and Figure 6.

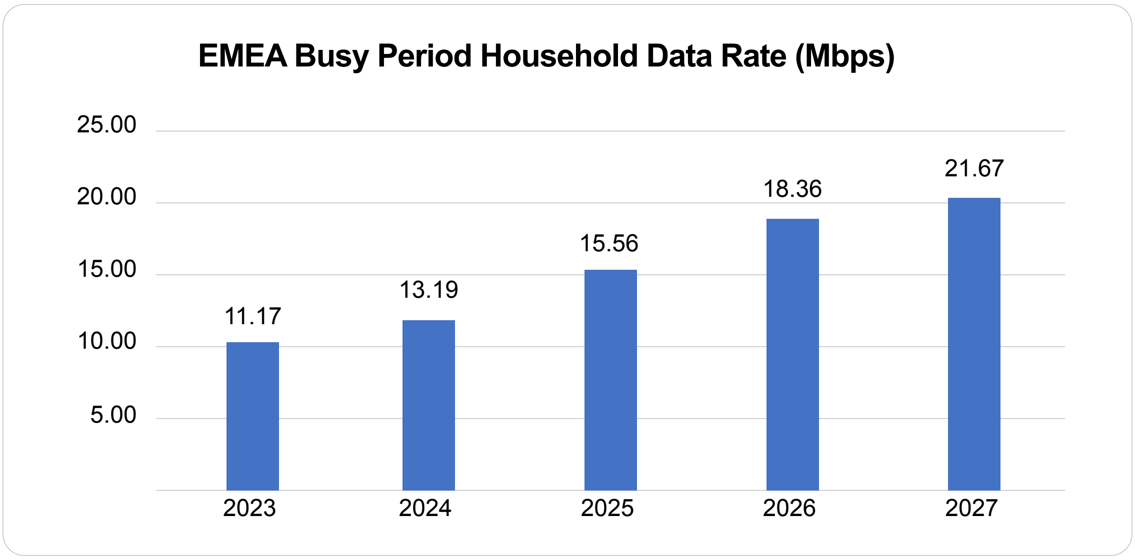

Figure 4. EMEA Forecast of Average Household Data Rates during the Busy Period (Prime Time)

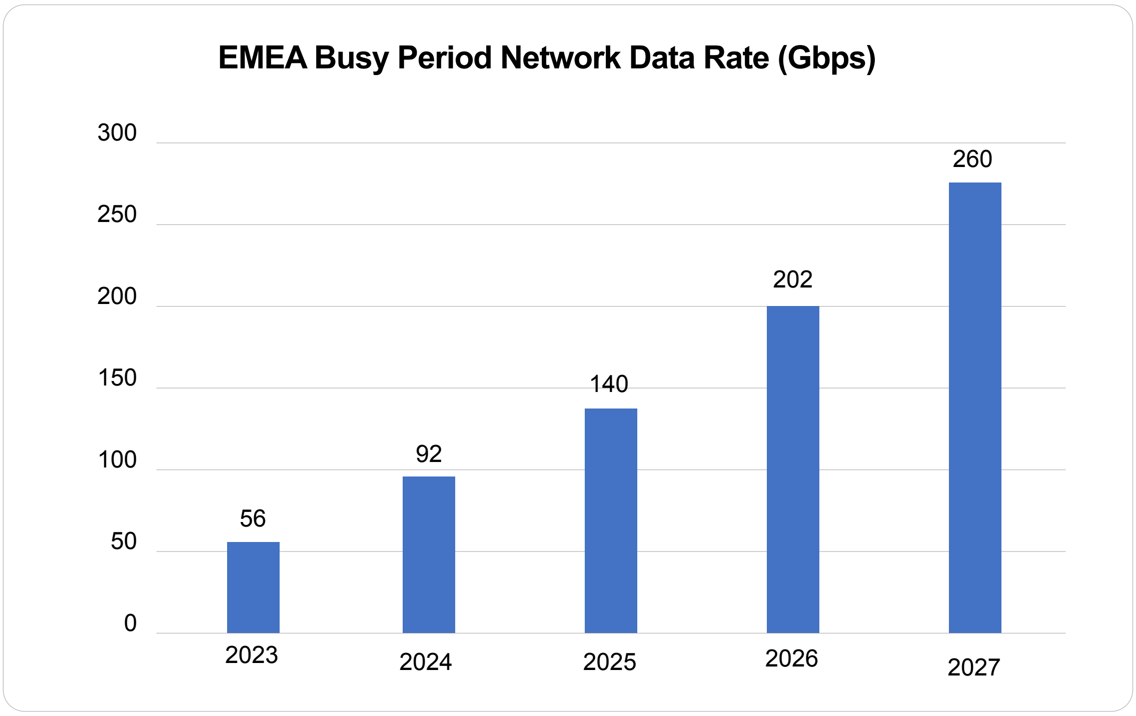

Figure 5. EMEA Forecast of Average Aggregation Network Traffic during the Busy Period

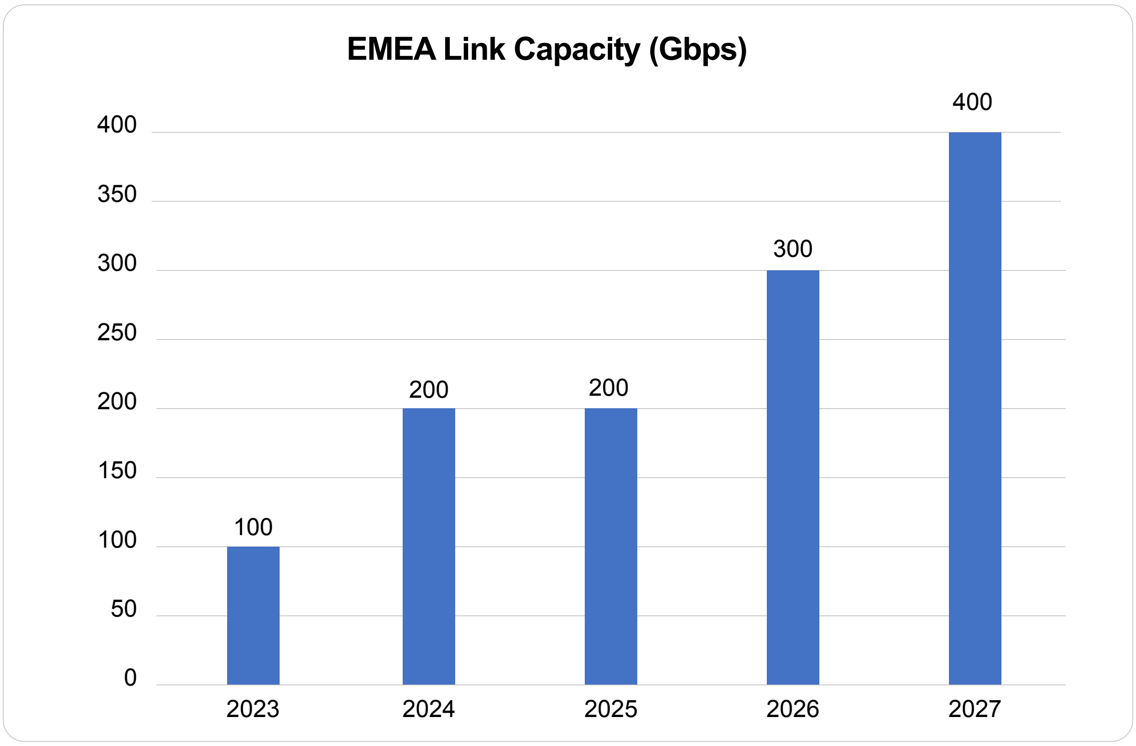

Figure 6. EMEA Forecast of Network Capacity Requirements Assuming Maximum Network Utilization of 75%

APAC Regional Traffic and Capacity Forecast

The forecast for traffic per household, aggregation network traffic, and network capacity requirements are presented in Figures 7, 8, and 9.

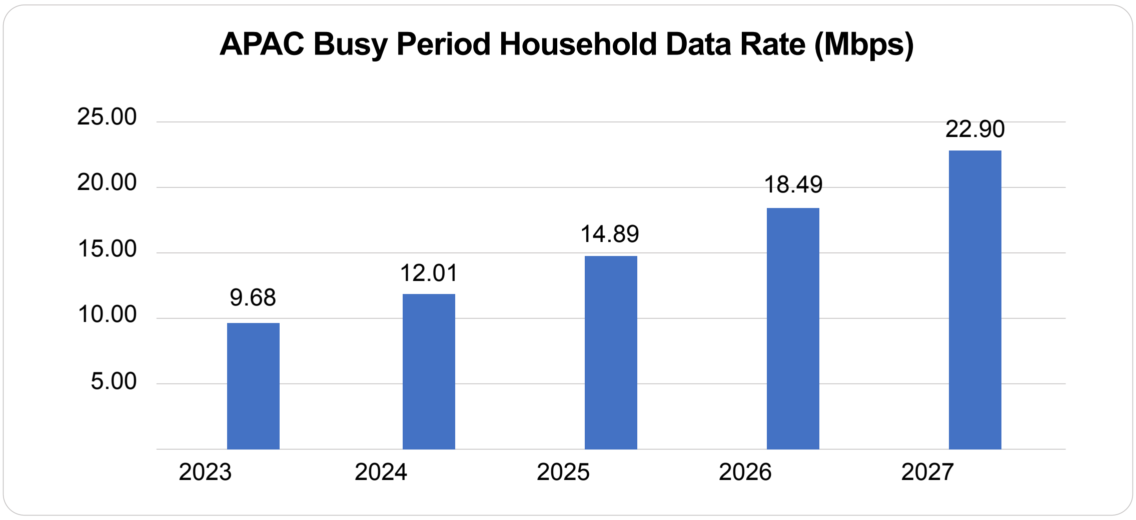

Figure 7. APAC Forecast of Average Household Data Rates during the Busy Period (Prime Time)

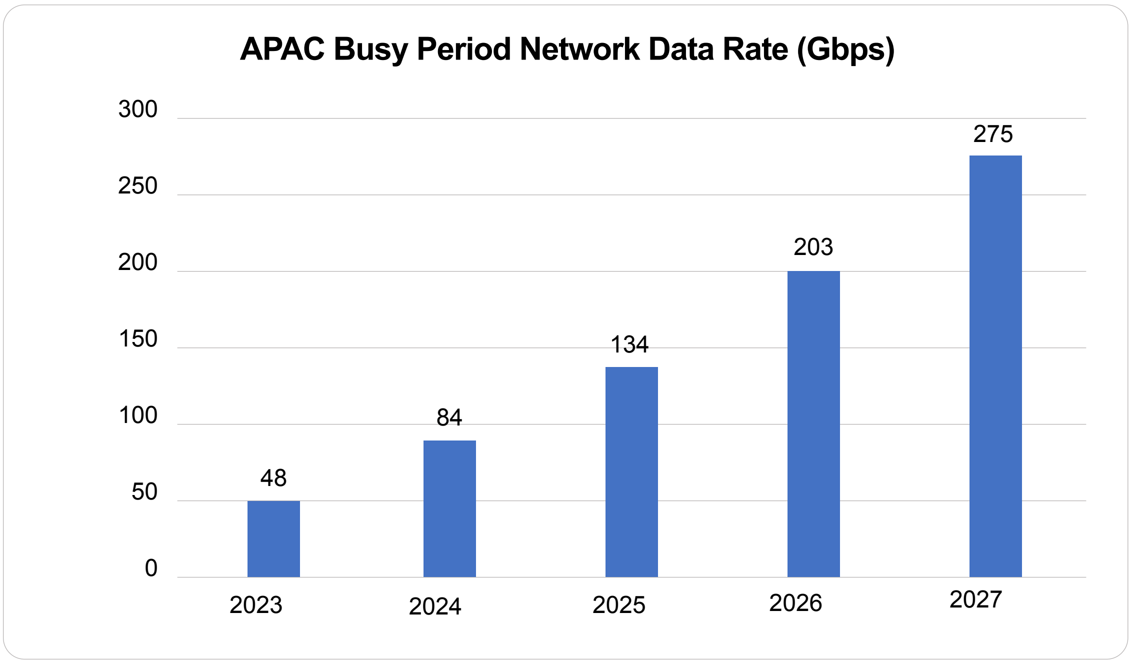

Figure 8. APAC Forecast of Average Aggregation Network Traffic during the Busy Period

Conclusion

This whitepaper introduces a forecast that accounts for regional variances in broadband usage patterns and the resulting network traffic implications. As broadband services continue to be an essential utility, service providers must anticipate and plan for the increased capacity requirements highlighted by our projections. The adoption of ring topologies and the strategic placement of edge caches will be crucial in managing peak traffic loads. Service providers should consider these forecasts in their long-term network development strategies to accommodate the evolving digital behaviors and ensure robust, scalable broadband services. The strategic insights provided herein will aid in navigating the post-pandemic broadband landscape, ensuring that infrastructure investments are both timely and effective in addressing the anticipated growth in network traffic.