



Smart Home Market Report

August 2022



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Executive summary

Data trends shaping tomorrow's customer experiences





Plume provides a window into today's smart home, with more than 41 million homes and more than 1.8 billion connected devices managed on its global network²

Given how many more connected devices are present in the average home than before, Communications Service Providers (CSPs) without a smart home strategy may be missing out on an opportunity to innovate while also increasing revenue. Empirical evidence shows consumers' growing reliance on their hyperconnected smart homes and the intelligent, devices that support them: pundits are predicting that global spending on Internet of Things (IoT) products will reach \$1.1 trillion next year¹.

At the rate things are moving, a wait-and-see approach is likely unwise. Competitive advantage today may be found through the ability to capture, analyze, and leverage AI and data to shape, customize, and optimize the customer experience. Forward-thinking CSPs may tap a deep well of data to put personalization and innovation at the center of their enterprise strategies. Already the constant and direct link into the customer's home, willing CSPs may be able to gain the insights they need to identify and address business problems, understand specific customers' behaviors, detect trends, and more.

Plume provides a window into today's smart home, with more than 41 million homes and more than 1.8 billion connected devices managed on its global network². Plume's CSP partners benefit from the aggregate intelligence acquired across Plume's entire customer base which they can leverage to innovate and roll out new services while delivering on their promise of game-changing speeds and bandwidth.

The data produced in smart homes may empower business transformation for CSPs, unlocking new improvement and growth opportunities across operations and functions:

 <p>Network optimization</p>	 <p>Intelligent security</p>	 <p>New monetization strategies</p>	 <p>Proactive customer service</p>
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With the right data, CSPs can set priorities that make the most business sense to their enterprise. We've compiled the key data points of the first half of 2022 to help Service Providers keep their smart home strategies on track.

¹ [The market for smart home devices is expected to boom over the next 5 years](#), World Economic Forum, April 29, 2022.

² [Plume powers more than 40 million active residential and small business locations with its cloud-hosted services](#)





Our methodology

The information in this report samples data from a cross-section of 200,000 homes out of the 41 million homes managed by the Plume Cloud across core regions: the US, Europe, and Japan. All data is heavily aggregated and therefore anonymous. Plume has managed more than 1.8 billion connected devices across its network.

Global averages are calculated using a weighted average of the three regions in which the weighting is proportionate to the population in each of the regions.

The study is based on a comparison of independent averages formed across the following two (2) time periods:

- January 1, 2021 to June 30, 2021 (1H 2021)
- January 1, 2022 to June 30, 2022 (1H 2022)

All data is based on the same set of homes that were present through 1H 2021 and 1H 2022 so that we can analyze the true growth. Averages are formed across all homes in the study, including homes that may not have a particular type of device. For example, the average data consumption per home for fitness bikes is low reflecting the fact that many homes do not have WiFi connected fitness bikes.

We have included all the connected devices that appear on home networks in any given month within the homes included in the study. This total includes “guest” devices that may have appeared temporarily, a factor that may affect the count of smartphones, but probably does not affect most other device categories*.

When values are given for data consumption or hours of use, the values represent the totals for all devices in that device category in the home. For example, if a value for data consumption for smartphones is provided, that value represents the sum of the data consumed by all smartphones in each home, averaged across all homes. Similarly, a value for hours of use per day of smartphones would show the total time all phones in the home were used per day on average.

* All device counts are based on devices that connect to the network via WiFi.



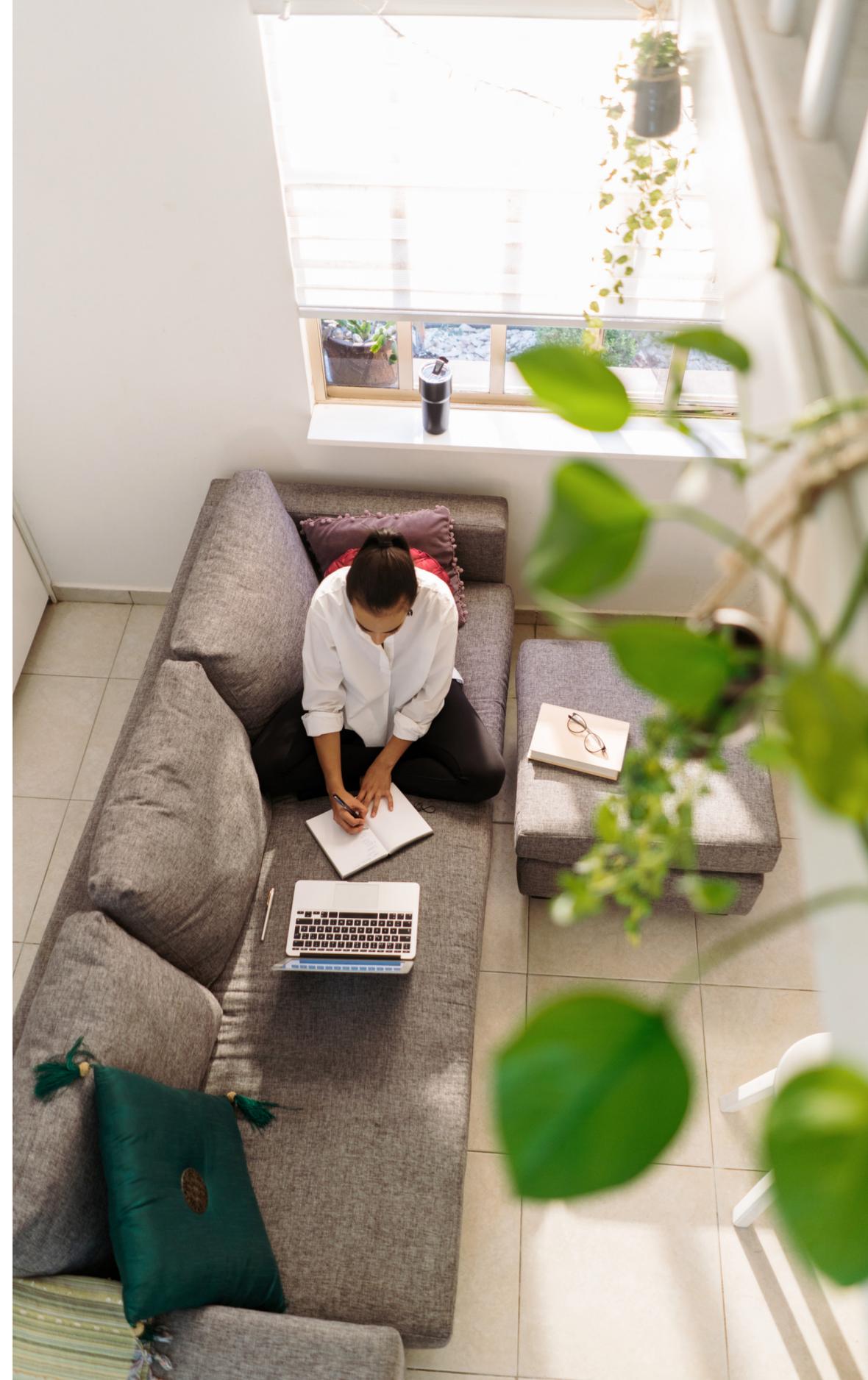


Tracking the evolution of the smart home

Thanks to the advent of the technology and the growing variety of devices and services available, homes around the world are getting smarter³. Consumers are spending more to make their homes more comfortable and secure, and at the same time have more control over their connected experiences.

The following data points sum up key network trends observed in Plume-powered households—in particular, growth in network as well as device deployment and usage.

³ [Homes are only getting smarter](#), Statista, April 2022





Home networks are growing by 10% globally

Consumers' growing appetite for IoT and smart home technologies shows no sign of slowing down—from digital voice assistants and high-tech security to energy management and smart appliances. Comparing data from the first half of 2022 to the first half of 2021, we see that Plume-powered households across the globe are adding significantly more connected devices: the average number per home is currently at 17.1, up 10% from 15.5.

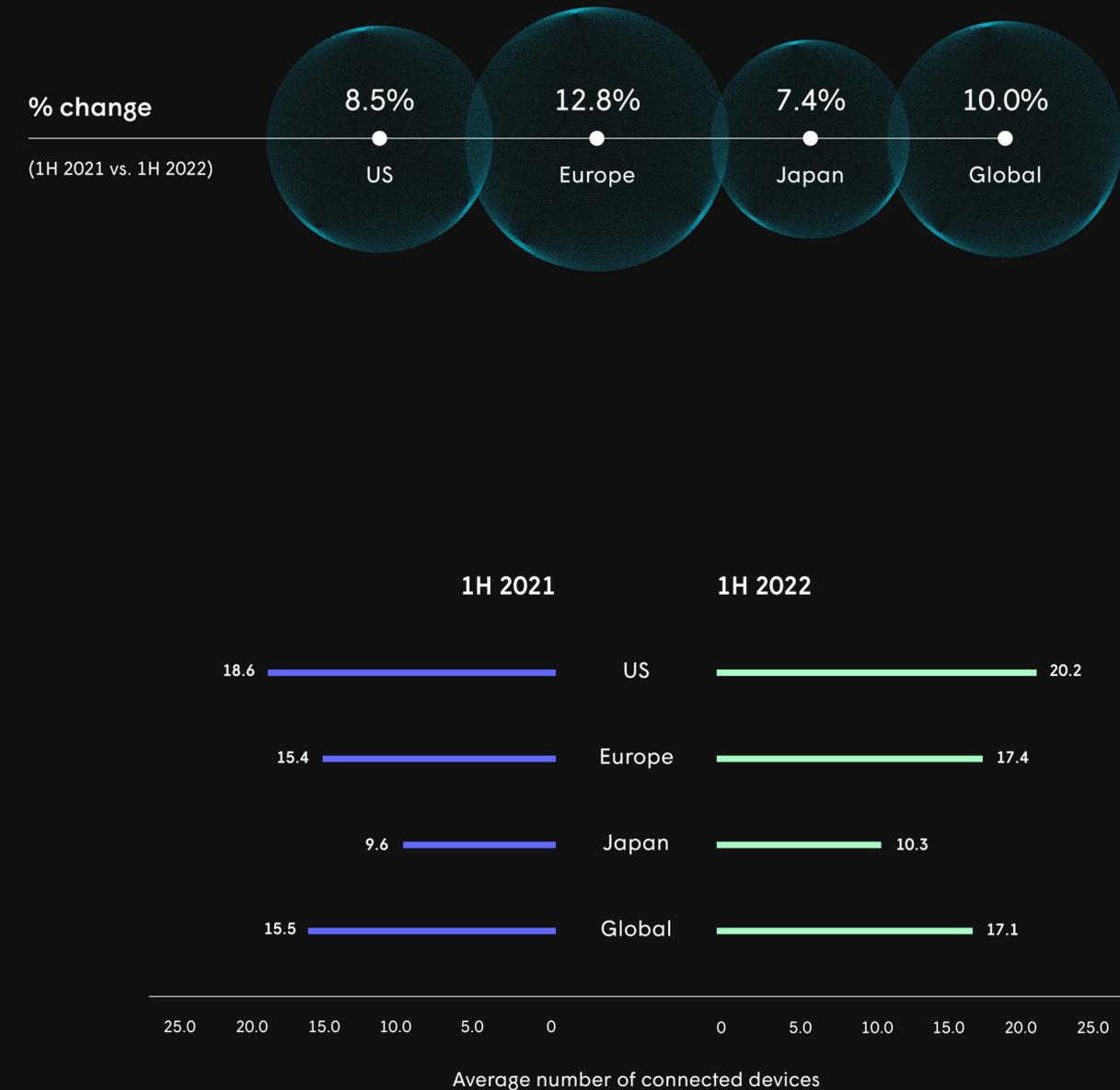
Smartphones remain the most popular device in Plume-powered homes, averaging over six per household across all locations, including “guest” devices that are allowed access to the network. Each household has, on average, two computers as well as a smart TV and tablet.

The biggest change is seen in Europe, where the average number of devices per Plume household jumped by 12.8%, from 15.4 to 17.4.

Japan, with an average of 10.3 devices per household, showed a smaller shift with only a 7.4% increase in the same time frame.

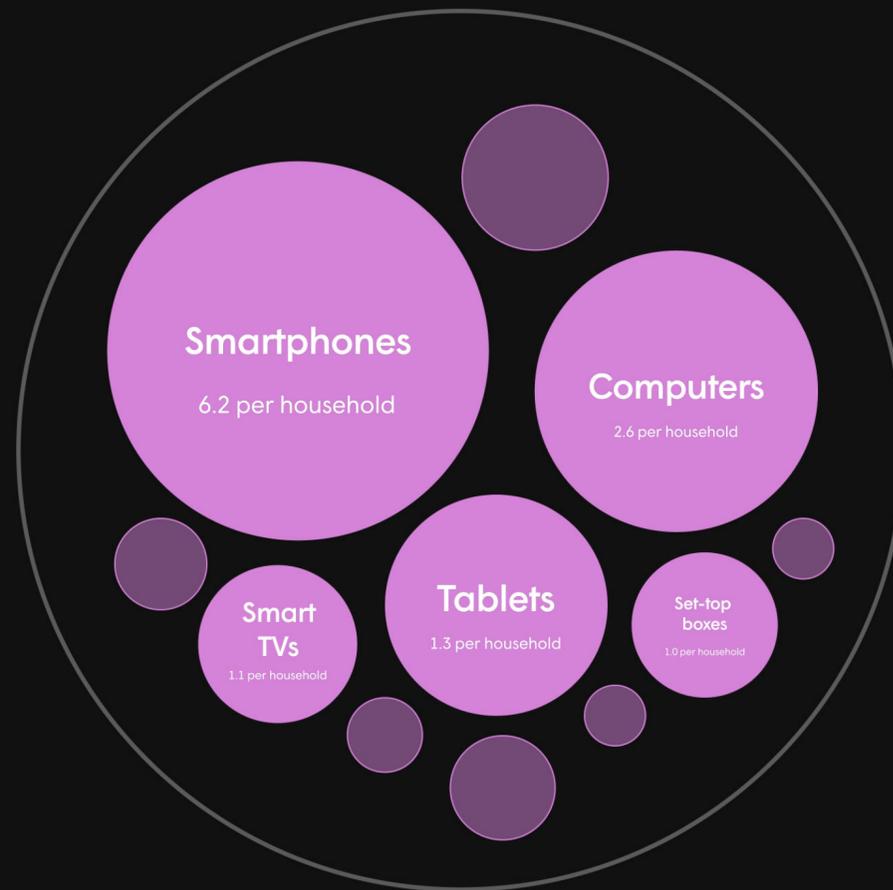
Plume-powered homes in the US have the highest penetration of connected devices to date, with an average of 20.2 per home.

Average number of devices per home

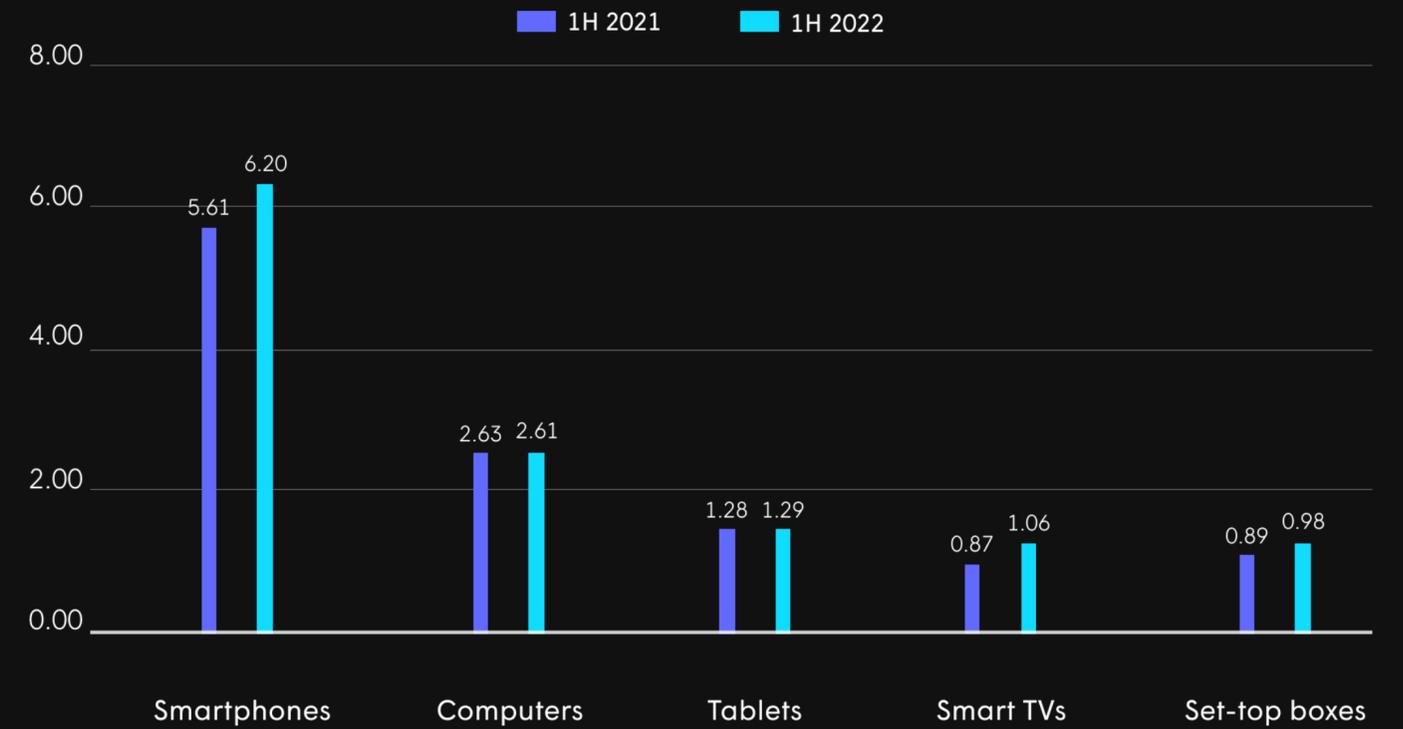




In 1H 2022, the most popular categories by number per household globally were



Average number of devices per home





More devices mean higher data consumption per home

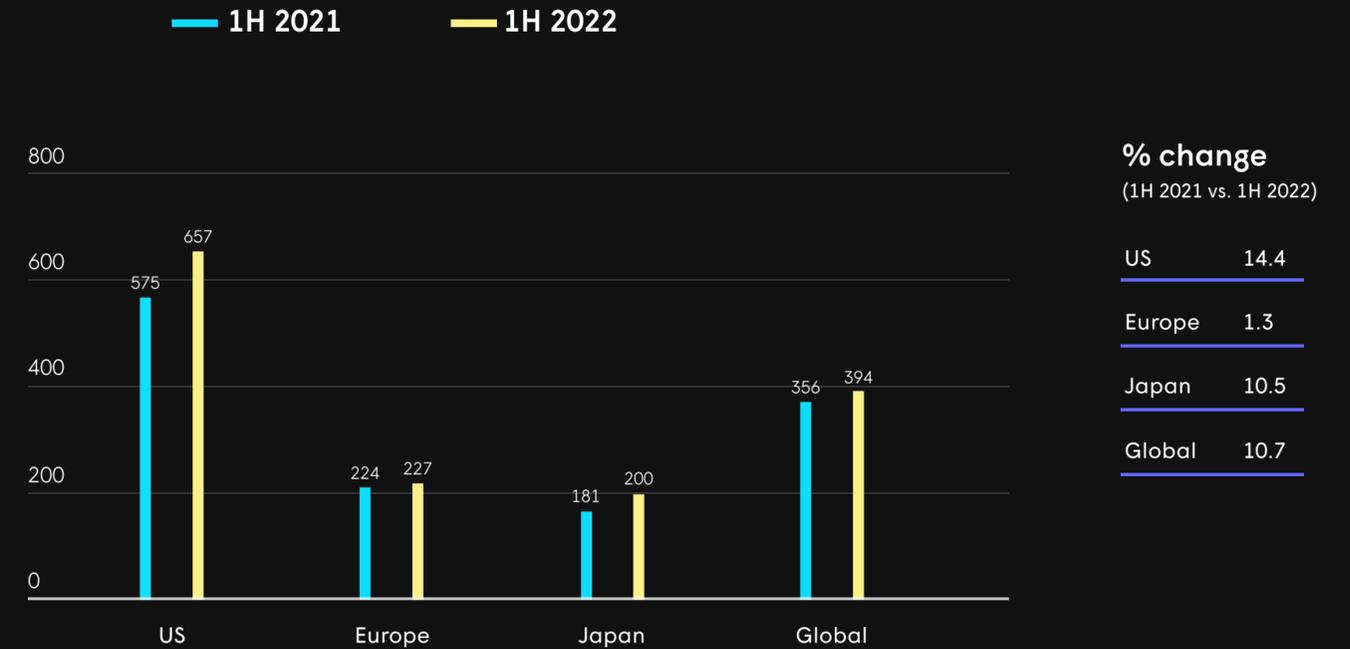
With more devices in the home, data consumption has been on the rise as well. As we are seeing up to 10% more devices in Plume-powered households, we are also seeing an upward trend (11%) in data consumption across the Plume network.

The US leads the charge with a high data consumption rate of 657 GB per month per home, 14.4% higher this year than in the same period in 2021.

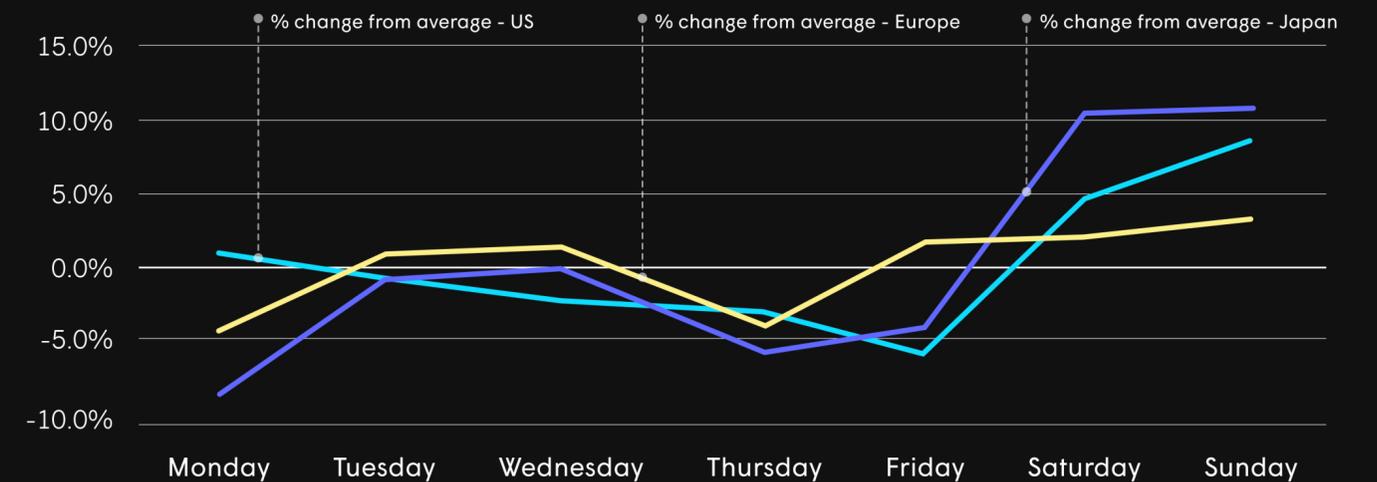
This is three times the data consumption of Europe and Japan, which are 227 GB and 200 GB per month, respectively.

In terms of daily network data usage per home, it remains relatively constant throughout the week in Europe. However, in the US and Japan, consumption increases noticeably over the weekend. Across all locations, it is interesting to note that usage dips just before the weekend on Thursday and Friday—a trend that is most noticeable in Japan and the US.

Average data consumed (in GB) per home per month



Change across the week in network data usage per home





The demand for faster upload speeds is increasing

A review of Plume data from the first half of 2022 shows an increase in broadband speeds across all territories compared to the first half of the previous year.

In homes with speeds under 500 Mbps (representing low- to mid-speed cable and DSL access), the global average download speed for Plume-powered networks is 199.7 Mbps in the first half of 2022, up by 13% from 176.1 Mbps in the first half of 2021. Meanwhile, upload speed has also improved, moving the needle by 32%, from 45.9 Mbps in 2021 to 60.7 Mbps in 2022.

This trend indicates a shift to more symmetrical speeds improving use cases such as video conferencing and work-file uploads and downloads, which have significant upload and download needs⁴. This is likely a by-product of how CSPs responded to the surge of demand for broadband communications service at the height of the pandemic when so many were required to work from home and socialize remotely.

Right now, even as the world moves into an endemic phase, there is still much uncertainty. Some version of remote work and virtual meetings remain very much a part of the post-pandemic way of life. In homes with speeds under 500 Mbps

Japan shows the highest growth in broadband speeds with 28% faster download speeds and a 45% increase in average upload speeds.

Europe's download speeds have not shifted as much as its upload speeds, which has increased by 42%. In the US, both download and upload speeds have increased at almost the same rate—by 19% and 20% respectively.

In homes with speeds above 500 Mbps (representing high-speed cable and fiber access), access speeds to homes are also going up across all locations: upload speeds are growing faster in Europe (up by 19%) and Japan (up by 27%) whereas download speeds are increasing in Japan (up by 38%) and the US (by 10%). The increase in upload speeds in this segment indicates the same shift to supporting more symmetrical applications as low- to mid-speed homes. That said, high-speed access services are already significantly more symmetrical, as fiber characteristically enables equally fast download and upload speeds.

While downloaded content still greatly outweighs uploaded (and most likely always will), the demand for faster upload speeds is increasing on all fronts.

⁴ Speed is measured to the main gateway.





Average network speed

Low to mid speed access homes (<500 Mbps)

High speed access homes (>500 Mbps)





What consumers want: Comfort, security, and convenience at home

The Plume Platform offers cloud-based management of in-home networks, which also gives CSPs visibility into what devices are being added to the home and how they are being used. The dominating theme here is comfort, convenience, and security—consumers in Plume-powered homes are investing in technologies that make them feel comfortable at home and save them both time and money.

The next few data points will explore the new and/or growing demand for smart devices.

DEFINITIONS OF CATEGORIES USED IN THIS PAPER

Set-top box: Includes Chromecast, Firestick, Roku, TiVo, Apple TV, some WiFi-connected set-tops, and set-top extenders from DirecTV, Dish, Comcast, etc.

Home hub: Includes IoT hubs such as Zigbee and Zwave

Media players: Includes iPods, Blu-ray, home cinema receivers, etc.

Smart TV: TVs that connect to the internet via WiFi or Ethernet





It's all about cameras, doorbells, and thermostats

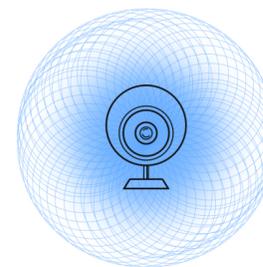
Since the pandemic, there's been an uptick in smart home device sales. Many would agree that there is greater interest in smart technology today than before. The biggest movers and shakers globally have been IoT devices. At Plume, we define any device that is not a computer, smartphone, or tablet as an IoT device. Comparing the first half of 2021 and the first half of 2022 there are:

- 55% more cameras
- 43% more smart doorbells
- 38% more home hubs
- 25% more smart light bulbs

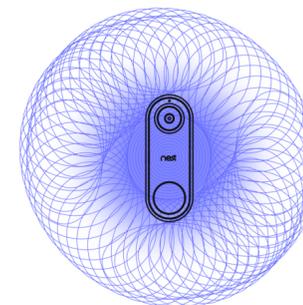
This suggests that consumers are interested in making their homes more comfortable and secure, and are capitalizing on the convenience that home automation brings.

Plume data also shows growth in the number of smart speakers (24%) and smart TVs (22%), which may be a direct result of the work-from-home era; when people spend more time at home, they want high-quality entertainment experiences.

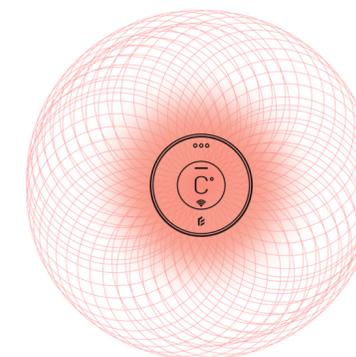
Voice assistants also show a continued upward trend (11%). Could this growth be driven by the desire for voice control of IoT devices? And although computers and tablets are two of the most popular categories by penetration, actual growth of these categories has stalled. By region, the highest growth categories were as follows:



+55%
cameras
US



+88%
smart doorbells
Europe

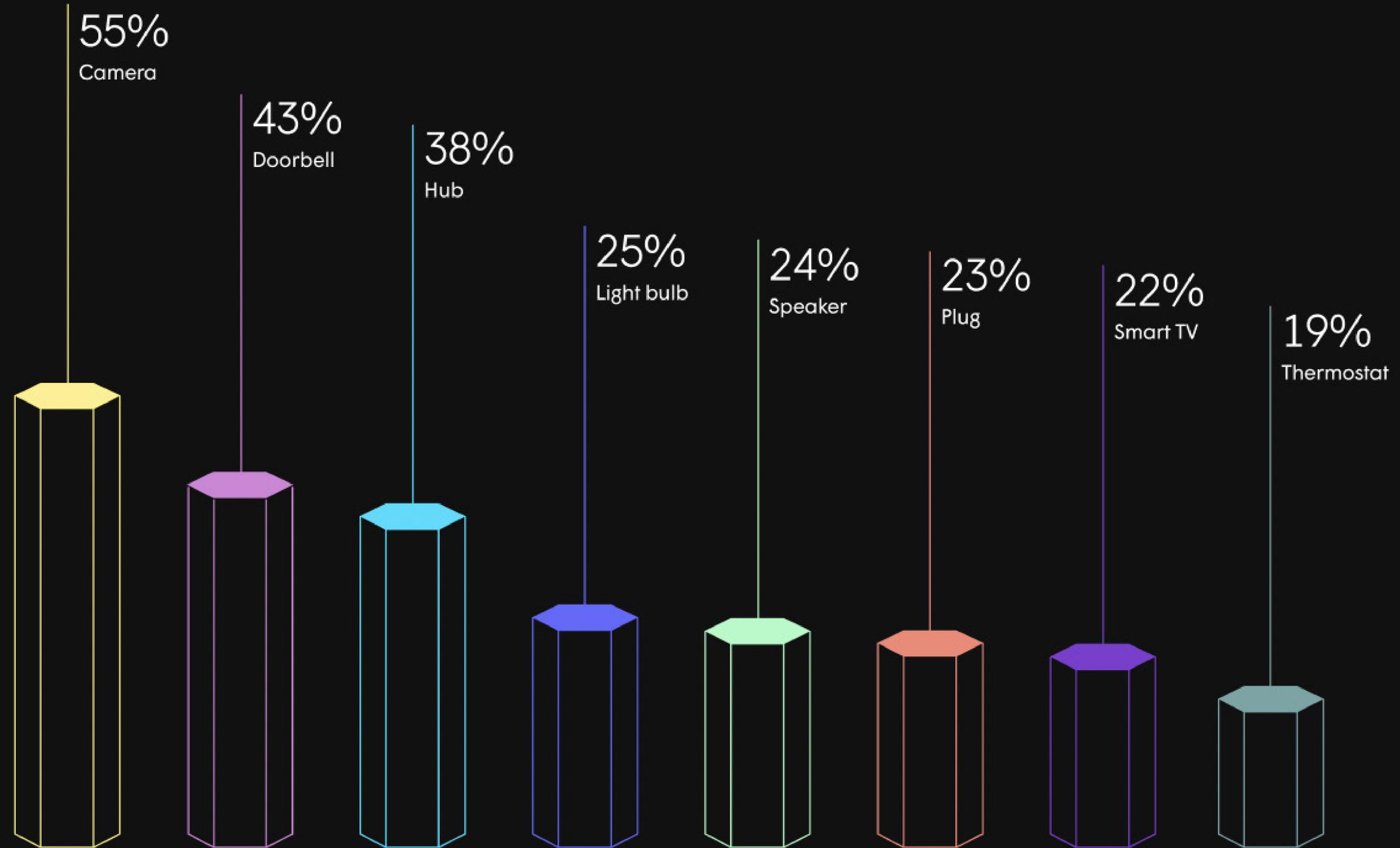


+106%
thermostats
Japan





Growth in average number of connected devices per home by category (global)





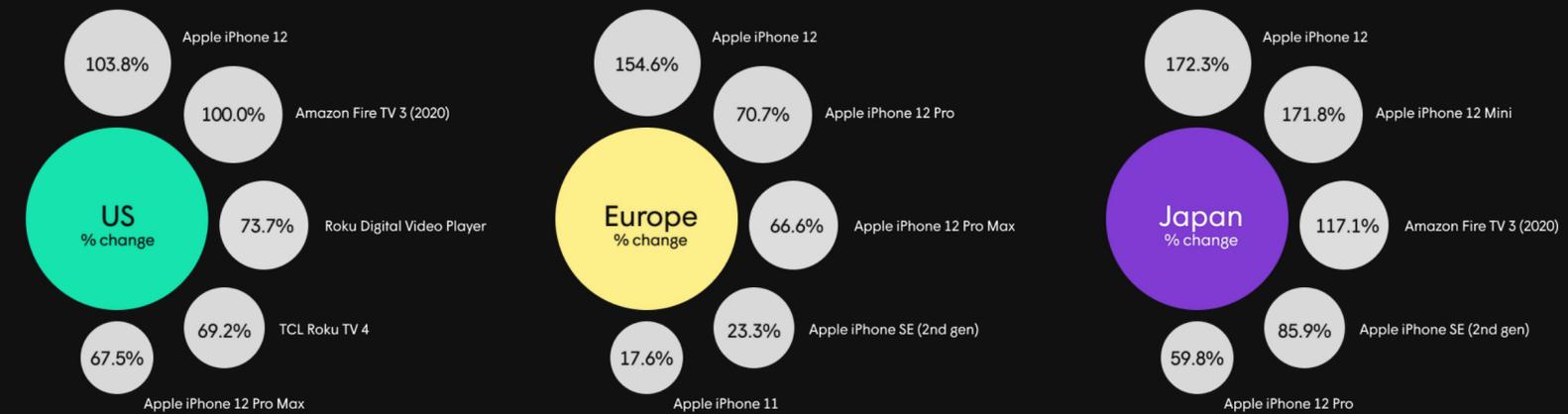
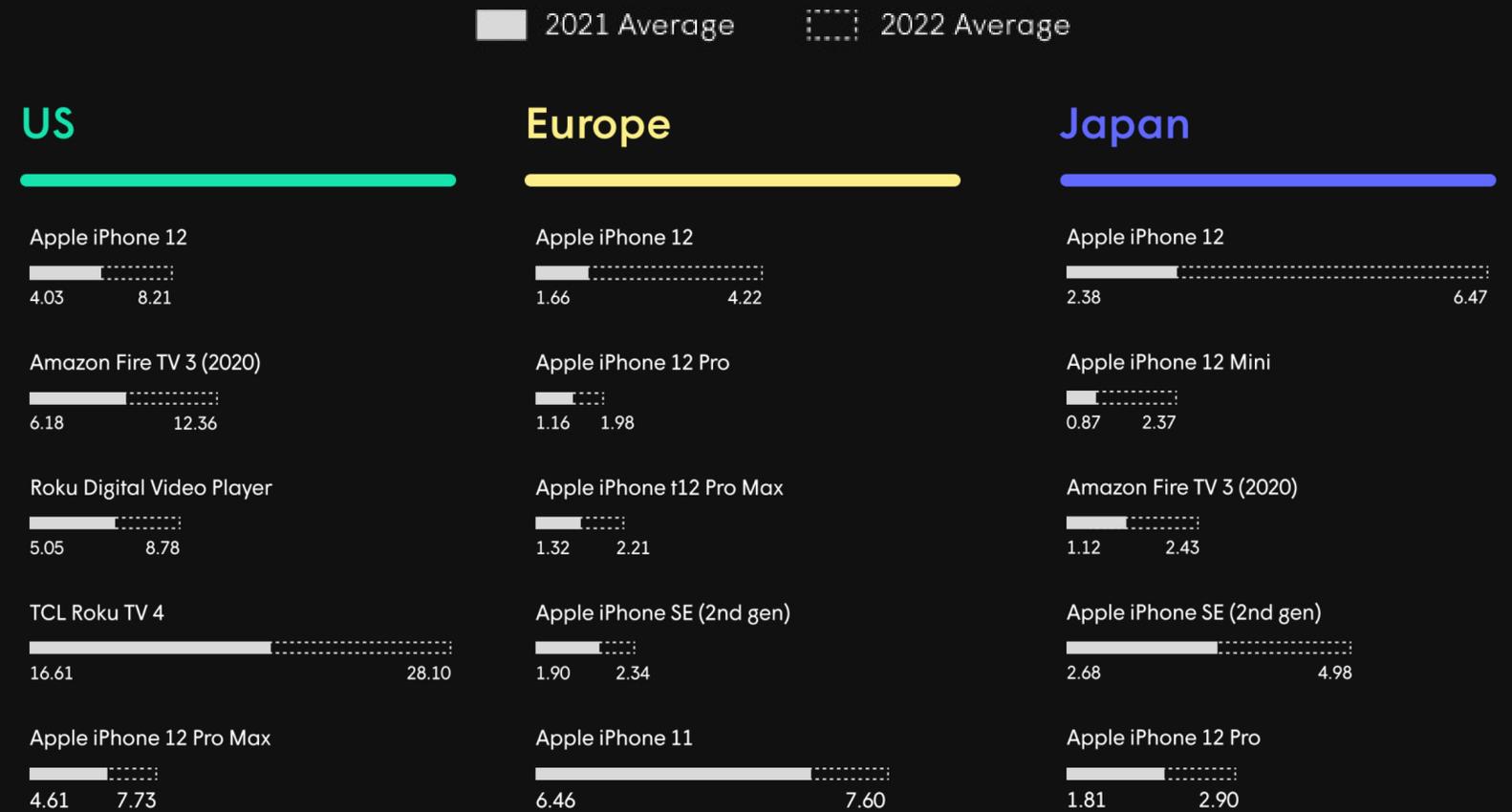
Top 5 fastest growing devices by data usage

Plume identified the top 20 specific device models by average data usage per home per month in GB. We then sorted that list by their growth rate from 1H 2021 to 1H 2022 to find the devices that are both heavily used, and whose usage is growing rapidly.

Plume data shows that across all regions, Apple iPhone 12's are the fastest growing data consumers among this set of heavy data-consumption devices.

In the US, Roku makes an entry as well. Across Plume's three main regions, we see high penetration of Roku devices in the US and Europe. Amazon's third-generation Fire TV Stick streaming device manages to break into the top 5 of this category in the US and Japan.

5 devices with the fastest growth rate in data consumption among the 20 highest data consuming devices for each region (average GB per month per home)





Which of the top 5 technology leaders has the most loyal brand following?

Does brand loyalty make a difference regarding which smart home products consumers want in their homes? While we do see the commanding presence of some brands in Plume-powered homes, trends do indicate that consumers have a high appreciation for interoperability.

Plume data shows that Apple dominates across all our brand loyalty indices, with “presence” (i.e., 1 or more same brand devices) in more homes, and in homes that we consider to be “brand-devoted” (i.e., 5 or more same brand devices) or “brand-obsessed” (i.e., 10 or more same brand devices). Microsoft has a higher presence than Samsung, but the data arguably shows that the Samsung ecosystem has more “devotees”. This is most likely due to the fact that Samsung has a more diverse product portfolio.

In terms of the percentage of change between the first half of 2021 and the first half of 2022, there have been stronger gains in the “devotion” and “obsession” categories. Apple, in particular, has achieved “obsession” in 23.9% more homes (10 or more Apple devices). Samsung and Amazon follow suit with growth of “obsession” by 17.2% and 17.9% respectively.

Brand loyalty for the top 5 brands (global)





Perspective: Data consumption profiles

Data consumption patterns can be revealing. If CSPs are able to collect it purposefully and react to it strategically, they can position themselves to compete against big tech companies like Google, Apple, and Amazon, who base their business models on data and who have been able to grow exponentially based on the way they collect and use their own data.

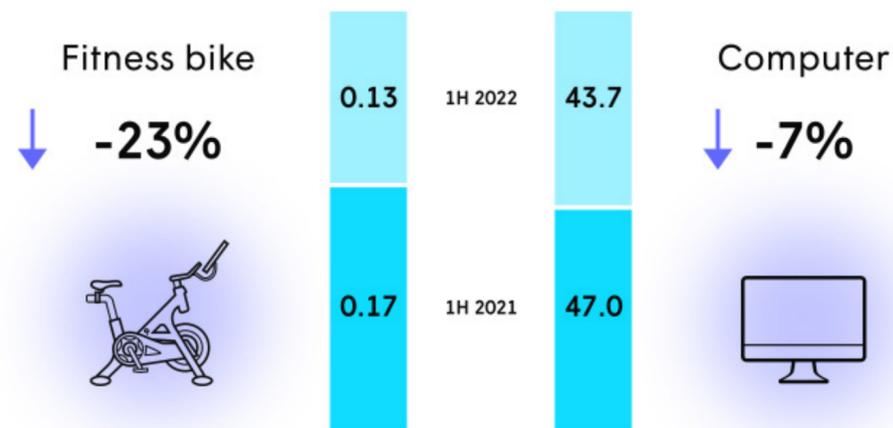
Understanding data-usage patterns and behavior of smart home owners enables better data-driven resource and business investment management, making it easier for CSPs to identify growth opportunities and develop strategies that may help CSPs meet (or possibly exceed) customer satisfaction and empower customer retention.





Work and workouts have moved out of home, but entertainment remains strong

Back to the office, the outdoors, and gyms
(Average GB consumed per month per home)



With the world reopened, and many of us back to business as usual—returning to the office for work, catching in-person concerts, and going to the gym—we do see a noticeable shift in data consumption by category as well as average hours of device usage per day.

The biggest decrease in data consumption is seen in fitness bikes—down by 23%.

People have understandably gone back to working out outdoors or at their gyms. Peloton, which ruled in many homes with its smart bikes and treadmills during the lockdown periods, has since been left with a glut of equipment and will be ending in-house manufacturing of its exercise machines⁵.

Computer data consumption has also decreased by 7%, likely as a result of workplaces reopening full-time or introducing hybrid working.

Interestingly, people are still seeking more media and entertainment at home.

Data consumption via smart TVs is up by 34%, speakers up by 27%, and set-top boxes up by 7%.

The use of media players such as iPods, Blu-ray, and home cinema receivers, however, have decreased by 14%—implying some preference by consumers for streaming video services using smart TVs or set-top boxes. The same trend can be seen in the average hours of device use per day, as smart TVs’ busy hours have increased by 27% while media players’ busy hours have decreased by 20%⁶.

Also showing a consistent increase in data and hours used are voice assistants, doorbells, and cameras.

In terms of brands, Apple devices continue to lead, showing consistent average data consumption in 2021 and 2022. However, the amount of data flowing through Google devices increased the most in the same period—up by 39%—which may be a reflection of the rise in popularity of IoT devices.

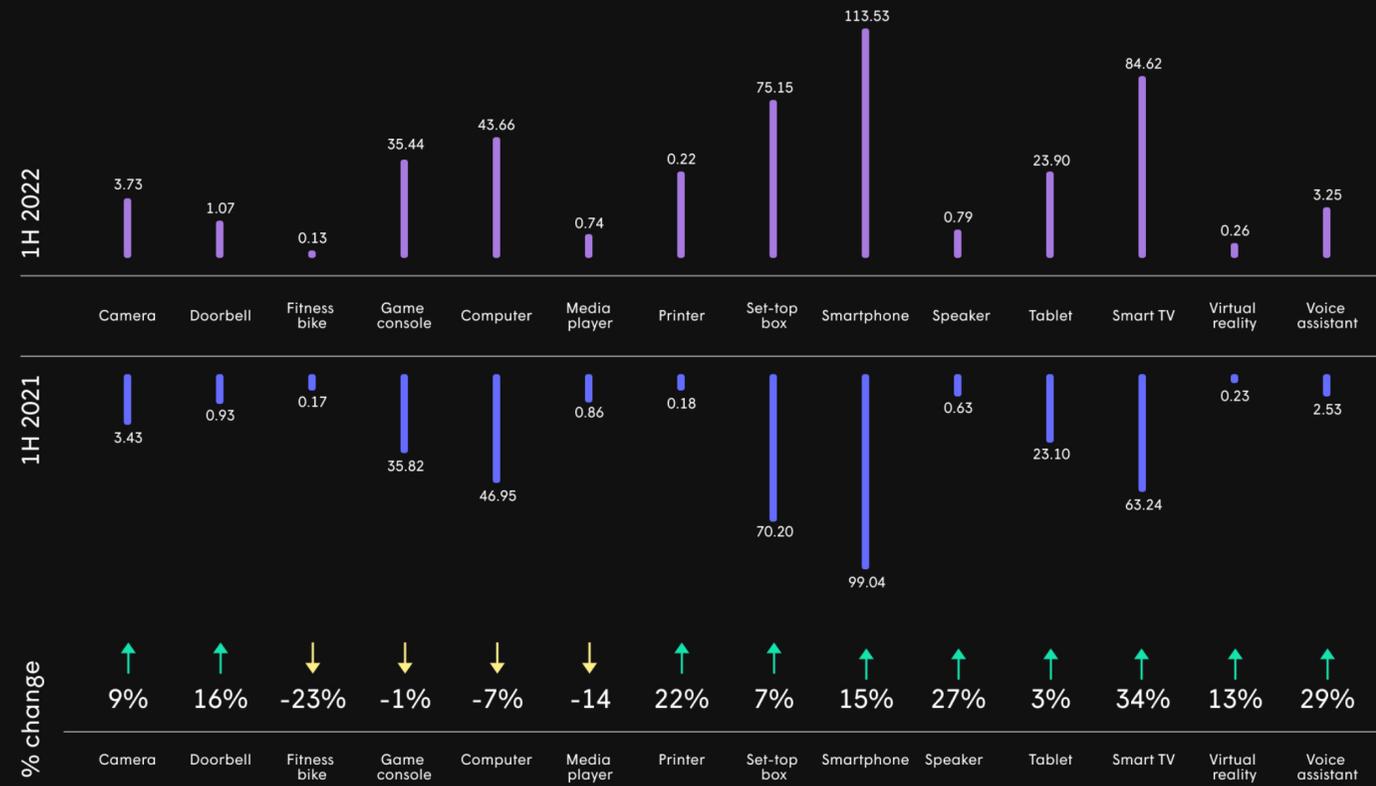
⁵ Peloton to Stop In-House Bike Production as Part of Turnaround, Bloomberg, July 12 2022.

⁶ [Video Streaming Market Size Worth \\$330.51 Billion By 2030](#), Grand View Research, April 2022

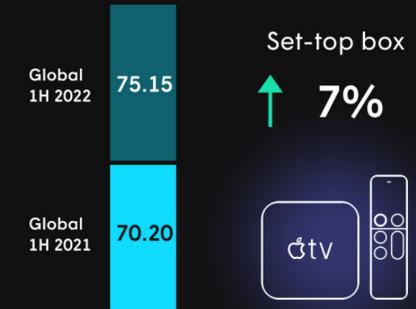
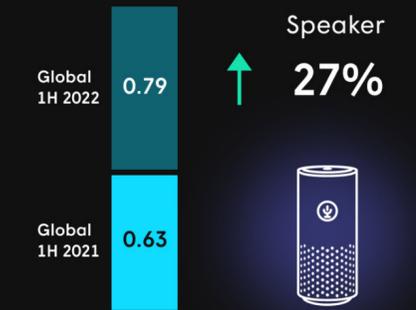
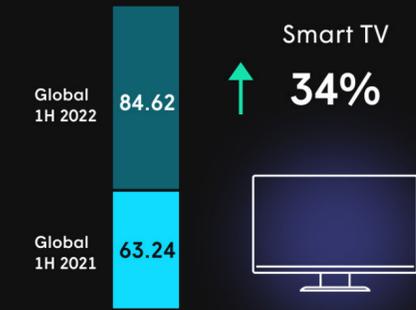




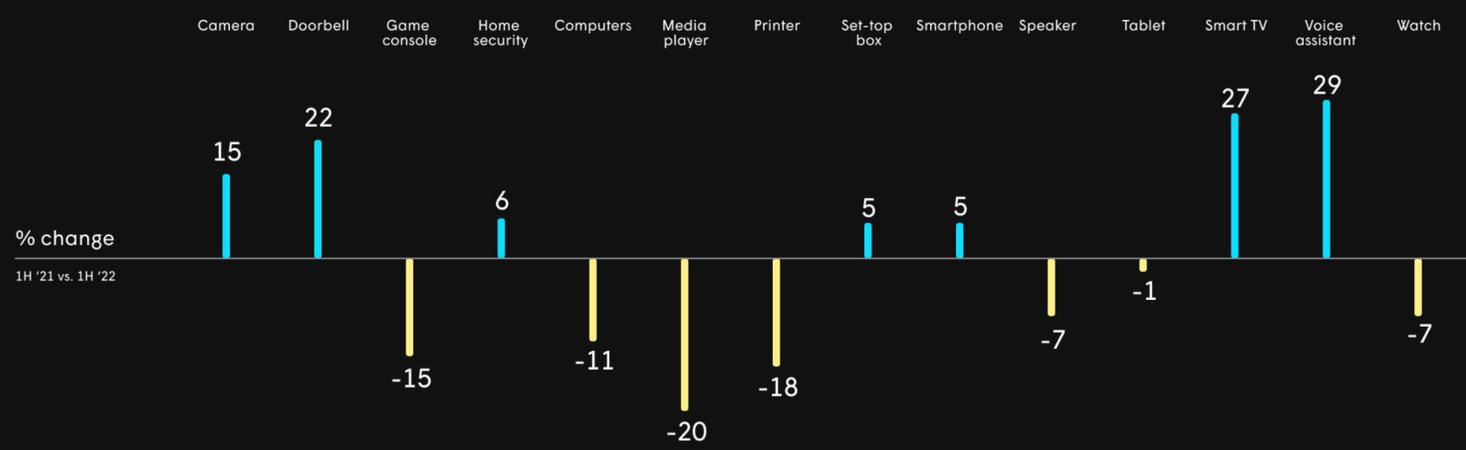
Data consumed per product category (Average GB per month per home)



Home entertainment on the rise (Average GB per month per home)



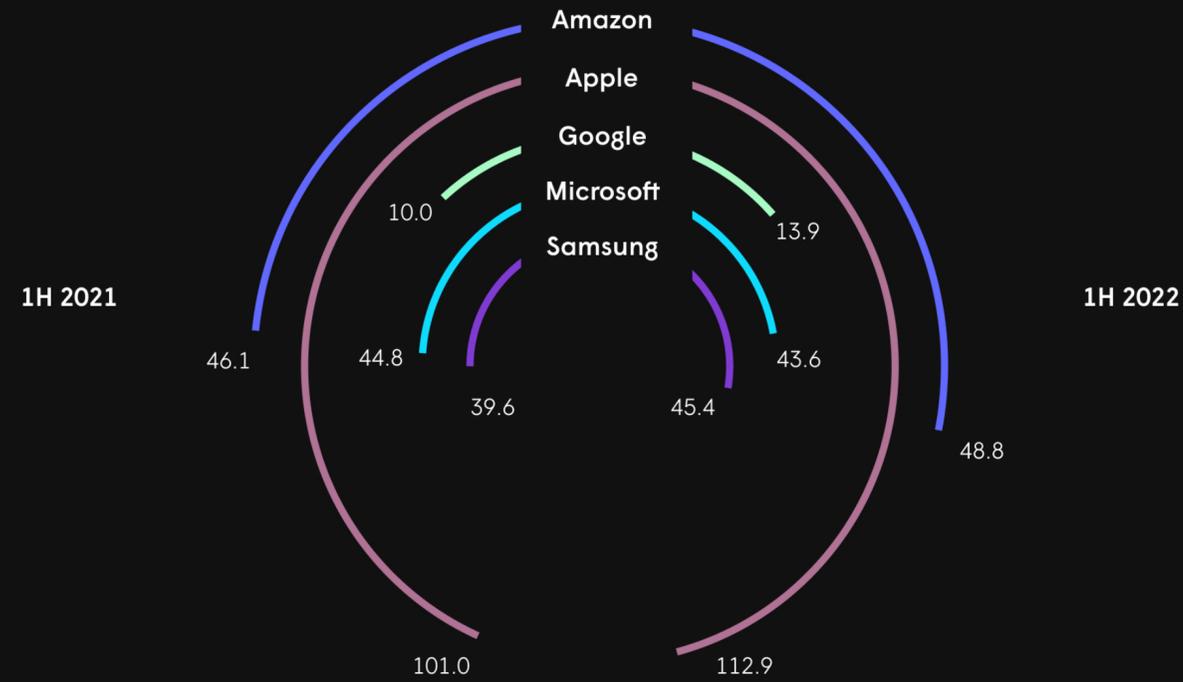
Busy hours (average hours of use per day)



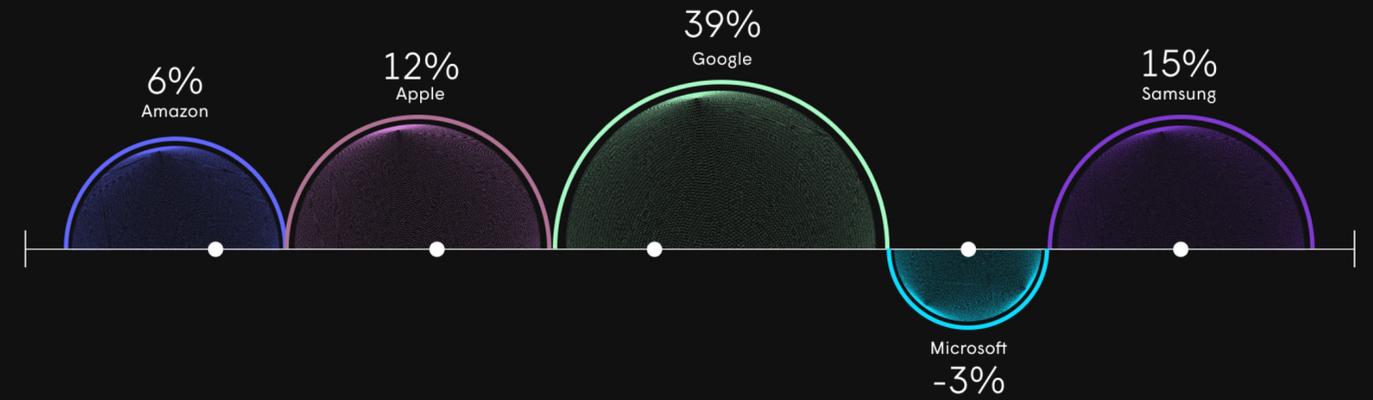


Data consumption by brand

Data consumption by brand, expressed as average GB per month per home



Percent change in data consumption 1H 2022 vs. 1H 2021 by brand





Charting cyber-security threats in smart homes

The growing number of devices in the home calls for a more secure environment, one in which consumers have more control over, and visibility into, their personal IT security. CSPs that are able to provide next-level cyber-security on top of fast, flawless connectivity will likely be valued over the competition.





Europe: Highest percentage growth in cyber-threats blocked

Globally, the average number of cyber-threats blocked by our systems in Plume-powered homes has significantly risen by 51% from 2021. The cyber-threat category that has grown the most is botnets, where threats blocked grew by 84%, followed by malware with a 58% increase, and spyware and adware, which grew by 40%.

Based on regions, the highest percentage growth in the average number of cyber-threats blocked when comparing the first half of 2021 and the first half of 2022 was in Japan (93%), followed by Europe (51%) and the US (42%). However, Europe, which already had high cyber-security threat rates in 2021, grew the most on an absolute basis (+27 threats per month on average).

Of all the regions included in this study, Europe had the highest number of cyber-threats blocked at 80 per month per home on average in the first half of 2022.

Could the rise in global cyber-threats blocked be attributed to the events in Ukraine and general socio-economic uncertainty which we know are often exploited by cyber-criminals?

European homes display the highest increase in cyber-threats blocked:

Cyber-threats on the rise

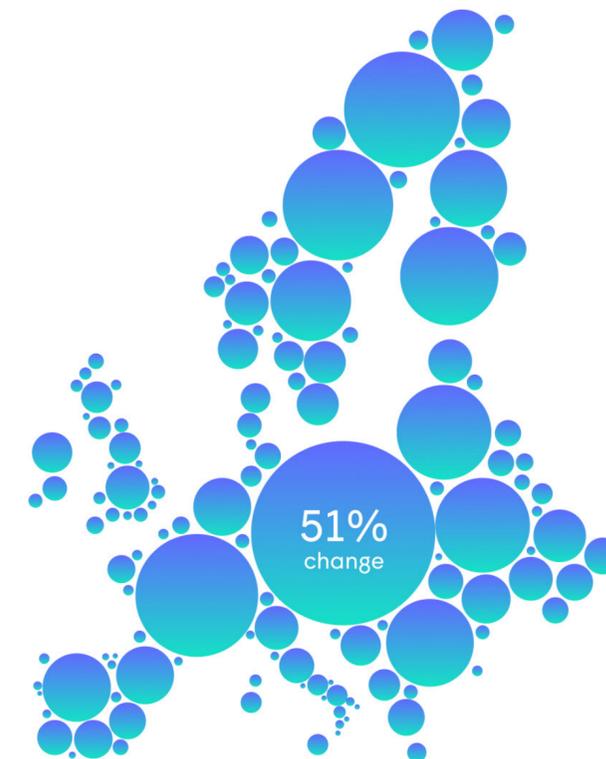
Europe

1H 2021

Total: 53.1

1H 2022

Total: 80.1





DEFINITION OF THE CYBER-THREAT CATEGORIES

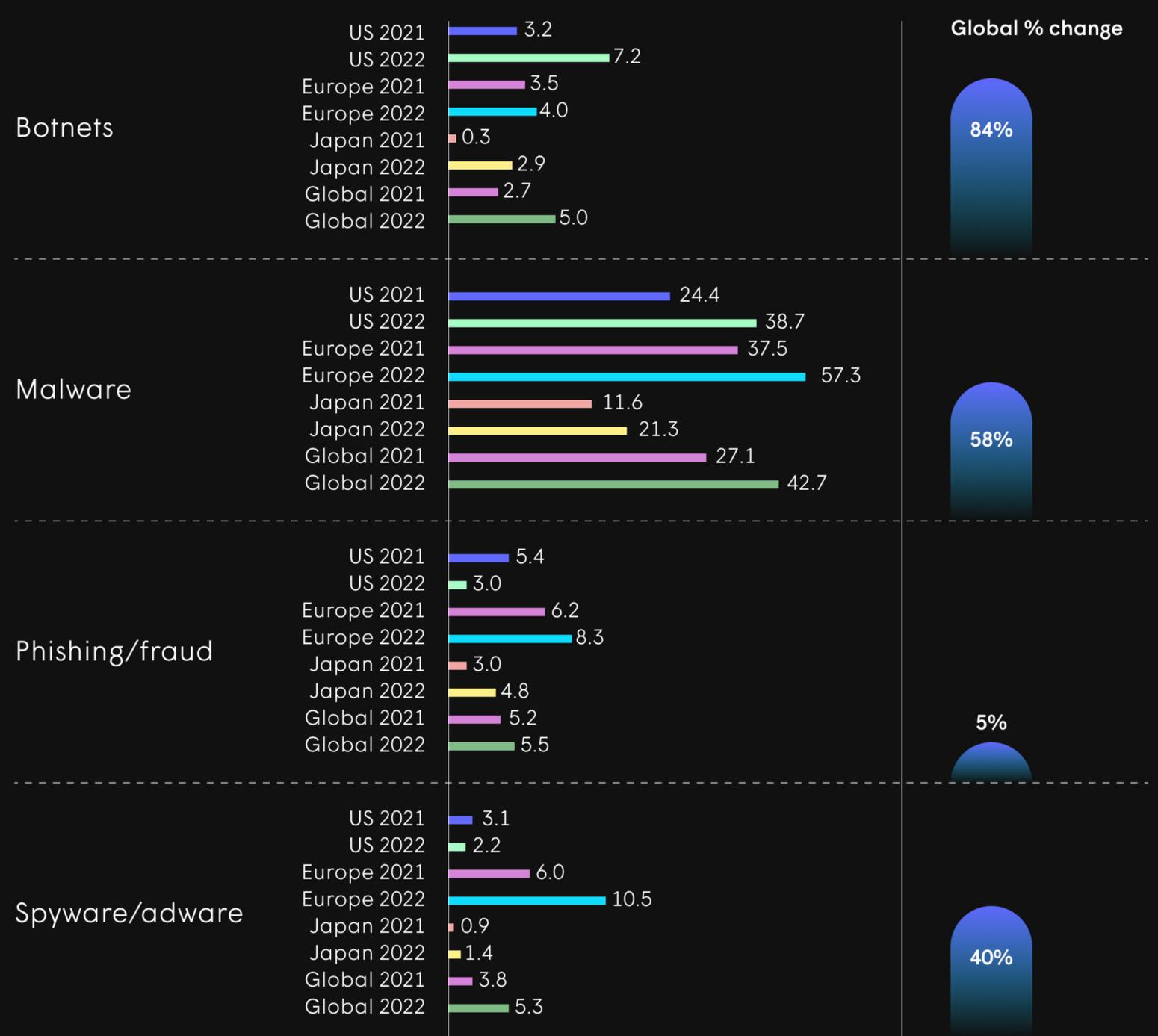
Malware: Software such as viruses, worms, trojan horses, ransomware, and crypto-mining software, designed to damage connected devices and networks

Botnets: Malicious software used to perform Distributed Denial of Service (DDoS). It attacks, steals data, sends spam, and allows the attacker to access the device and its connection.

Phishing and other fraud: Sites that appear legitimate but fraudulently capture user-sensitive data like usernames, passwords, credit card info, SSN, etc.

Spyware, adware, and spam: Sites that are used to distribute spam like unsolicited bulk emails, messages, intrusive adware, and hoaxes.

Cyber-threats blocked per month per home by type





Growth in network and device deployment and usage requires more sophisticated management





Plume performs several types of optimizations, including a nightly optimization that aims to avoid interference the next day, and a “fast interference” optimization that reacts on-the-fly to high levels of interference when they occur. As environments become more congested with more networks, more devices, more data consumption, and more minutes of use, the occurrence of high levels of interference increases. The frequency of “fast interference” optimizations reflects the importance of countering increasing interference and is a measure of how generally congested our home networks are becoming.

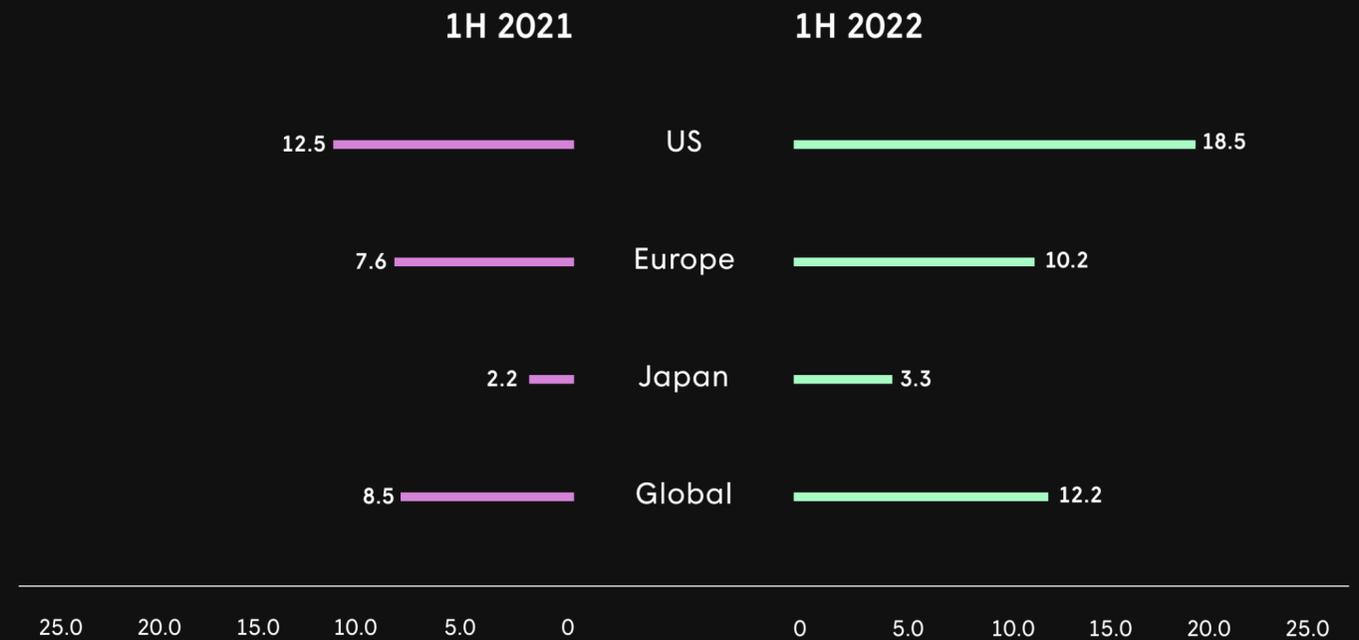
In this data, we observe several things of note:

- The demand for networks to dynamically react to high levels of interference is relatively high; approximately ten times per month, or once every three days on average.
- The need to perform these interference-reactive optimizations has grown significantly period over period—globally, this need has increased by 43%.
- Across regions, the demand for interference-reactive optimizations follows such trends as the number of devices per home, the amount of data consumed, and the minutes of use of devices.

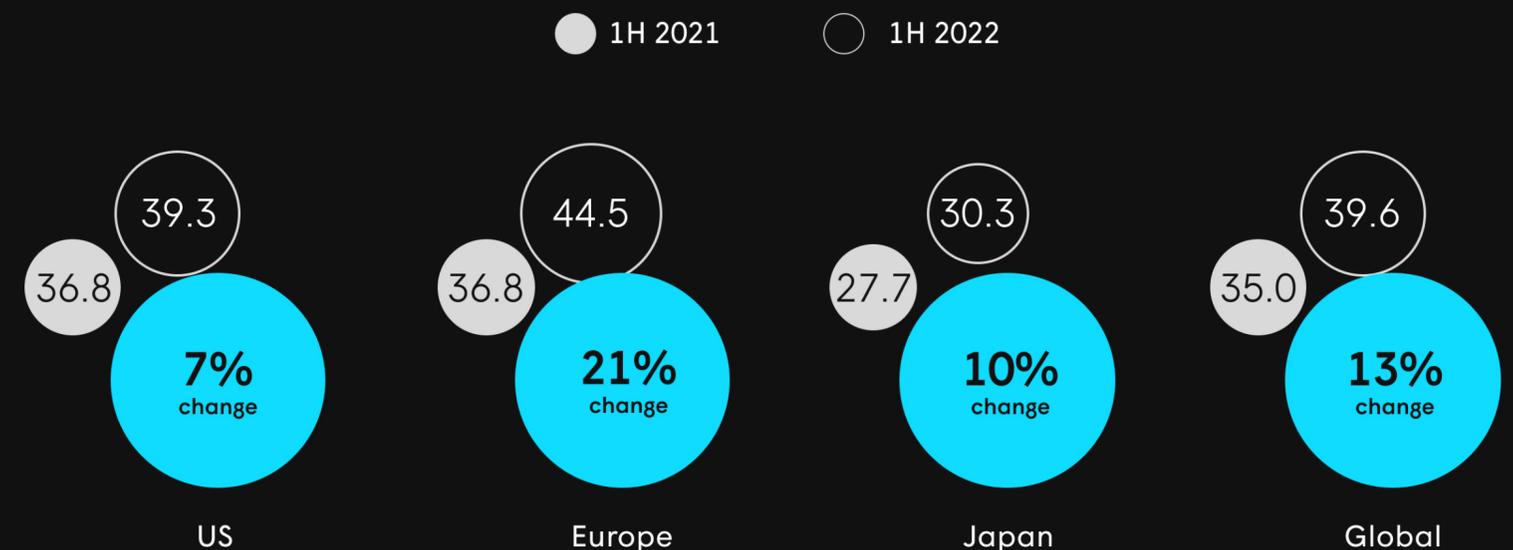
Additionally, Plume data indicates an increase in the average number of neighboring WiFi networks the typical WiFi AP sees—a stunning average of 40 in 2022, up 13% from 35 in 2021.

As neighboring WiFi networks cause conflicts that directly impact Quality of Experience, there is a heightened demand for sophisticated interference management.

Average number of fast interference optimizations per month



Average number of neighboring networks





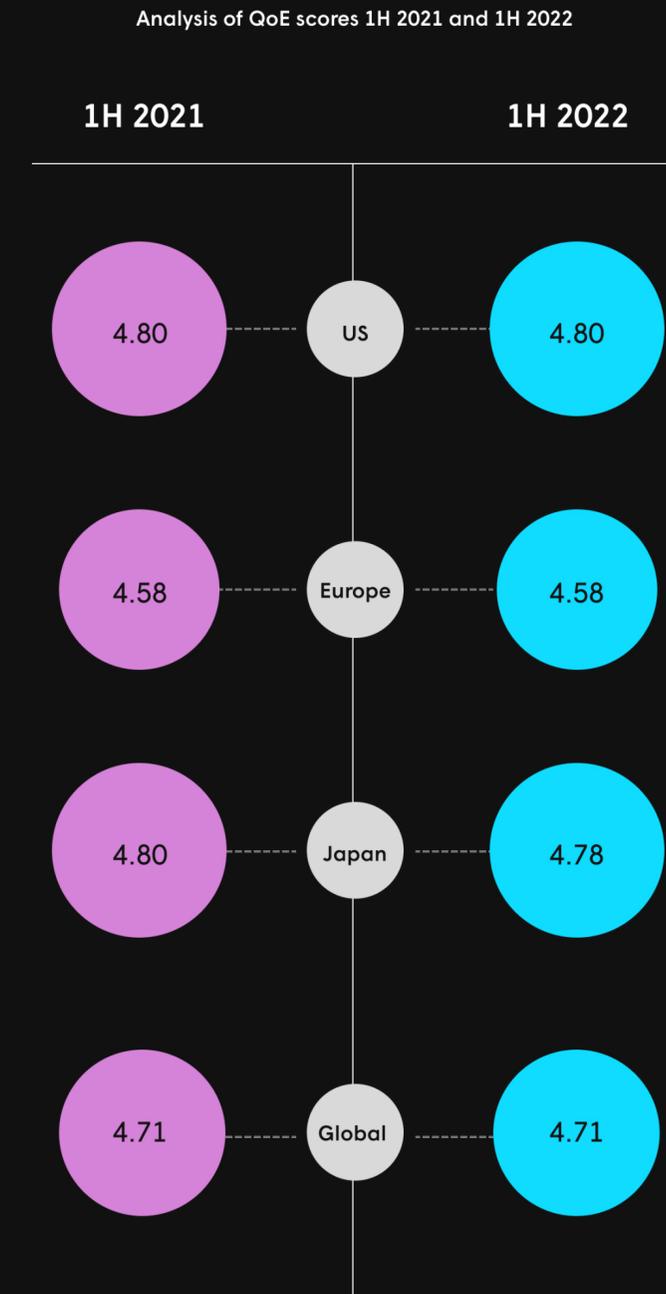
Quality of Experience

Traditional assessments of home-internet connection quality may reliably determine whether a network is fast or slow, but they rarely consider the specific devices within the home and what resources those devices need to work as intended. With this in mind, Plume created the Quality of Experience (QoE) metric providing CSPs with a more accurate way to measure customer experience.

The QoE metric can measure whether a device has sufficient WiFi connection to ensure that the user's experience of that device or service will be good. A device is scored from 1 to 5, with the 1 being the lowest value, representing a device that is working very poorly. A score of 5 indicates that a device will have no issues that can be detected by the consumer. Plume's QoE scores factor the type of device, its needs and applications, and the condition of the entire network in which the device is operating, including signal strengths, data rates, packet error rates, interference, and self-congestion on each hop required to traverse the entire network.

Plume actively adjusts and optimizes the network configuration to maximize device QoE. This is why quality of service to customer homes has remained high with minimal variation for both 2021 and 2022 despite an increase in device deployments and network growth and usage.

Analysis of QoE scores 1H 2021 and 1H 2022





Conclusion

Plume gives CSP partners access to data-driven intelligence and customer-focused insights from more than 1.8 billion connected devices that have been managed in the Plume Cloud. This report has provided quantification of many trends that affect CSPs operations, customer satisfaction, and financial opportunities.

Comparing the first half of 2021 to the first half of 2022, the data has quantified the significant increases in all three of the main “loads” on CSPs networks: the number of devices, the amount of data the devices consume, and the number of hours that those devices are active. Not only is the number of devices important, but the types of devices that are becoming popular is critical to understand as well.

The impact on CSPs’ networks is demonstrated by the data regarding the growing numbers of interference-driven optimizations and neighboring networks that need to coexist. Not only is network management becoming more challenging, but network security is as well. The data shows cyber-security threats requiring action growing in virtually all categories and all geographic regions.

Meeting growing smart home demands is a sound strategy for CSPs. With the relevant actionable insights to strengthen their current and future smart home plays, they have a viable future in the works:

- Monitoring growth in networks—as well as device deployment and usage—can lead to better resource management and tech investments with long-term ROI.
- Understanding behavior and consumption patterns offers the potential for improved precision in channeling funds toward impactful upgrades and services-portfolio expansion.
- Knowing where and how customers are spending on smart home upgrades can allow for smarter decision-making in key areas of innovation.

Armed with the right data and understanding, CSPs can plan and prepare for the needs of their networks and consumers. By leveraging machine learning, AI, and cloud data, Service Providers can position themselves to provide the quality of experience and services that customers desire.





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