Independent market research and competitive analysis of next-generation business and technology solutions for service providers and vendors

HEAVY READING WHITE PAPER

Broadband Subscriber Demand:
A More Immersive Experience

A Heavy Reading white paper produced for DZS

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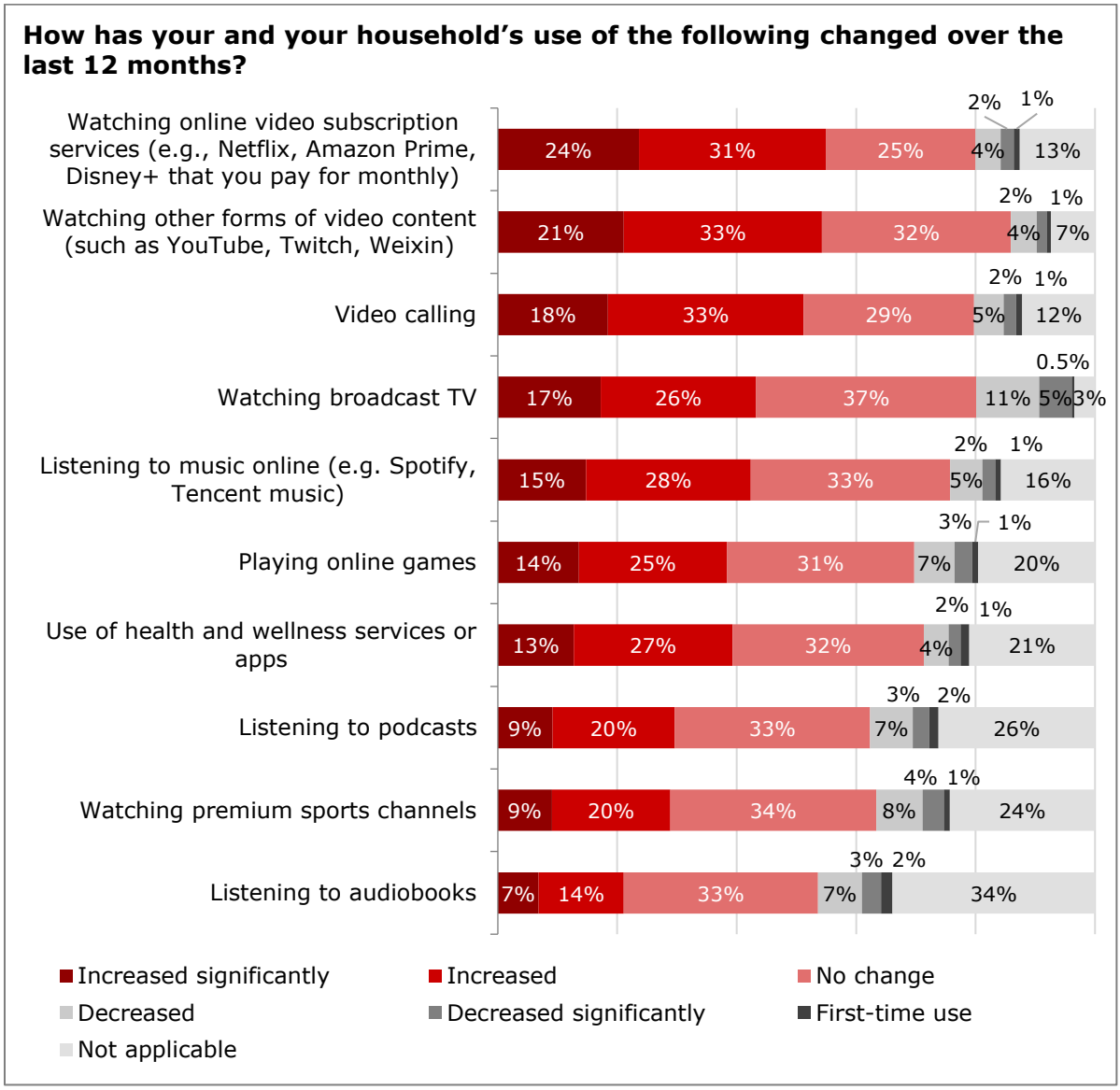
THE EVOLVING RESIDENTIAL EXPERIENCE

The residential broadband market today is very different from the market of early 2020 at the start of the global COVID-19 pandemic. Abrupt changes in demand, required reliability, bandwidth, traffic patterns, security, and application mix have transformed the market. All evidence points to the fact that these changes will not recede as the pandemic loosens its grip. Rather, they will accelerate. Omdia's 2021 global survey of over 13,000 consumers (see **Figure 1**) shows an increase in demand, across the board, for online applications, whether for staying in touch, entertainment, or healthcare. Note that no one country accounts for more than 10% of the survey responses. These are global trends.

Figure 1: Consumers have increased their reliance on online services and entertainment



n=13,285

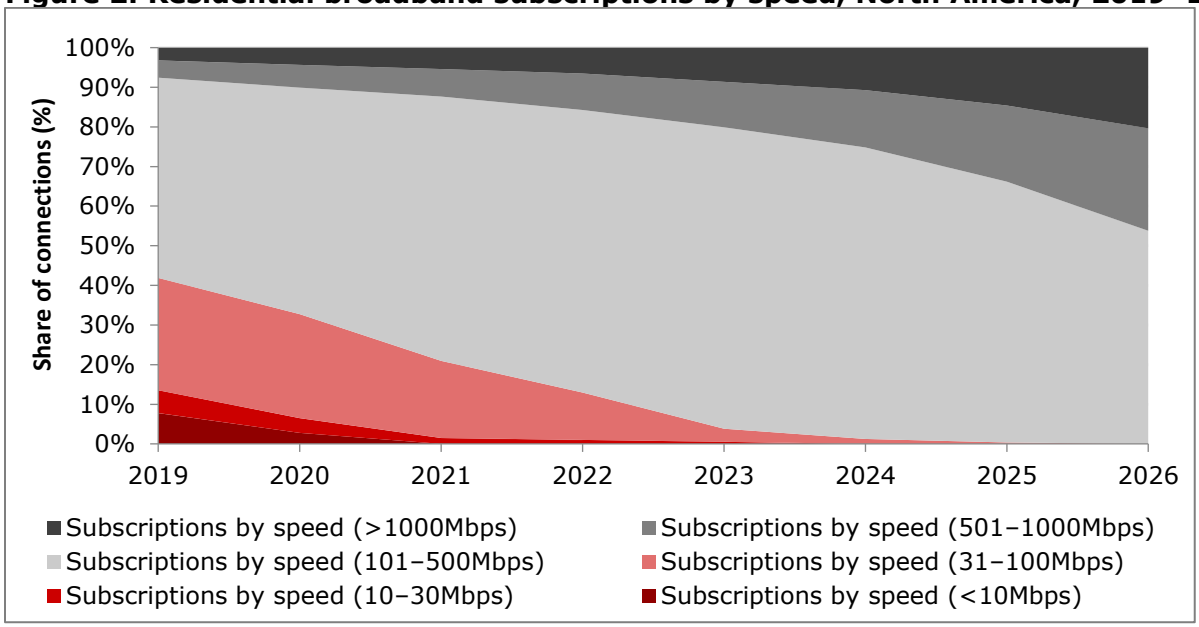
Source: Heavy Reading, Omdia, Digital Consumer Insights 2021 – Smart Homes

Between a quarter and over half of the respondents experienced either an increase or a significant increase in the use of these apps. In addition, despite fears that COVID-19 might stunt market growth, the pandemic has accelerated digitalization and the adoption of fixed broadband. Residential broadband subscriptions grew 7.3% year-over-year (YoY) in 2020 and 8.0% in 2021 as consumers grew increasingly dependent on digital services. This trend is expected to continue as fixed broadband reaches 1.54 billion subscriptions in 2026. Growth will be largely driven by the expansion in fiber connectivity, which grew 14% in 2021, and fixed wireless access (FWA) services, which grew 22% YoY in 2021. Heavy Reading has seen increased PON investment in every global region, and we expect communication service providers (CSPs) to intensify their rollout of fiber throughout the next five years and beyond. The question is: Will these rollouts drive or be driven by (or both) consumer adoption of high bandwidth and low latency demanding applications?

Is residential broadband hitting the glass, or fiber optic, ceiling?

A 2022 Omdia survey of over 760 fixed broadband service providers across 178 geographies found that 60% of those surveyed offered 1Gbps or higher services, up from 45% in 2019. Looking just at North America, out of 160 fixed broadband service providers surveyed, 88% offer 1G broadband services today and 16% already offer multi-gigabit services to residential consumers. Examining it from the perspective of consumer subscriptions, Omdia's current data for North America shows that 80%+ of broadband subscriptions today are for services at 100Mbps or greater. By 2026, the end of the forecast period, 67 million subscribers, *representing 50% of all North American broadband subscribers*, will be contracting for services of 500Mbps or greater.

Figure 2: Residential broadband subscriptions by speed, North America, 2019–26



Source: Heavy Reading, Omdia, "How gigabit became the broadband standard" (May 2022)

Broadband services driving demand

Since 2019, work from home, remote learning, and e-services have evolved from modest implementations to become commonplace. Bandwidth consumed in the average home has eclipsed rates from prior years; this trend continues in 2022. Households were once considered "power users" when their monthly data usage was 1TB or more. That is now regarded as average.

Bandwidth-intensive, low latency apps are no longer reserved for business services. The residential market is seeing the accelerated adoption of many applications with demanding usage profiles, starting with high definition video (HDV):

- **HDV:** 4K HDV requires support for 60 frames per second. 8K video requires up to twice that capacity, or 120 frames per second. That translates to 25Mbps of connectivity for 4K to stream one video and 100Mbps for 8K video streaming. Streaming two videos simultaneously requires twice the bandwidth: 50 Mbps for 4K and 200Mbps for 8K. Resolution is the tip of the iceberg – TV technology is quickly cycling through advancements targeted at enhancing challenging content, for example live streamed events, sports, gaming and telemedicine. Display technologies are moving beyond LCD to quantum dot (QLED) and organic LED (OLED). Refresh rates are evolving from 60hz to 120hz and will eventually take us to 240hz – giving us sharper action footage, particularly on LCD HDTVs. These evolving technologies will provide a better customer experience to users. More importantly, they will enable new applications and new content that leverages and, in fact, relies on advanced video technologies.
- **Video conferences:** A Zoom or Microsoft Teams conference call, whether for work or remote education, requires far less capacity—about 1.2Mbps of connectivity for 720p HD video and 3–4Mbps for 1080p HD video. However, these services are not buffered. They are sensitive to both jitter and delay. The user experience will suffer with more than 150ms of latency or more than 40ms of jitter.
- **Gaming:** Gaming demands anywhere from 20Mbps to 300Mbps of connectivity depending on how dedicated a gamer the user is. In addition, low latency is critical for gamers. Latency above 100ms can affect game play. While 40–60ms of latency is considered optimal, competitive gamers look for latency that is closer to 20ms. These network parameters will only become more stringent as gaming apps evolve, competitive gaming becomes mainstream, and gaming apps embrace virtual reality (VR).

Consumers entered 2020 and the start of the pandemic using the above applications. The first thing to change was that the entire family was home all day. They were using these applications more (as seen in **Figure 1**), and they were using them *simultaneously*. There have been numerous studies conducted about the work-at-home phenomena and how at least a third of the workers who were compelled to work from home due to the pandemic have stated that they will never go back to an office full time. The home network must now function as a branch network with all the performance, resiliency, and security that it entails. In addition, it must be able to support new classes of applications, including those described below.

Esports

Omdia forecasts the total global market for esports will grow from $2,083m in 2022 to $3,100m in 2026. Much of this impressive market is non-network related and can be attributed to sponsorships (such as Intel's Extreme Masters tournaments), ticket sales to live events, media rights, and streaming advertising. In 2022, consumer contribution (revenue from consumer spend on compendiums for esports events or battle passes for virtually attending esports events) accounts for $236m. This network-dependent segment is forecast to grow to $295m in 2026.

Telehealth

Telehealth or telemedicine leverages the network to exchange health information and provide healthcare services, overcoming access barriers. Services include remote medical diagnosis and evaluations, video consultations with specialists, sharing of medical imaging, and outpatient follow-up. Service providers are well positioned to support these services through the provisioning of secure networks and have been expanding solutions to include both business-to-business (B2B) and business-to-consumer (B2C) offerings. Dozens of service providers have tailored B2B offerings targeted at, for example, insurance and diagnostics. More recently, the industry has seen the rapid introduction of B2C offerings from service providers such as Airtel, Boost Mobile, HKT, SKT, Telefónica, and TELUS.

For example, Telefónica partnered with US-based global telemedicine provider Teladoc Health to launch the subscription service Movistar Health, which enables consumers to speak with a primary care doctor 24×7. During the video (or audio) consultation, users can get medical analyses or tests and private e-prescriptions prescribed by the doctor. The telehealth service uses artificial intelligence (AI) to perform a digital evaluation of symptoms to provide guidance and a recommendation on the level of medical interaction required. Users will also receive a personalized diet and exercise plan designed by doctors and nutritionists with weekly emails of diets, exercise guidelines, and support materials.

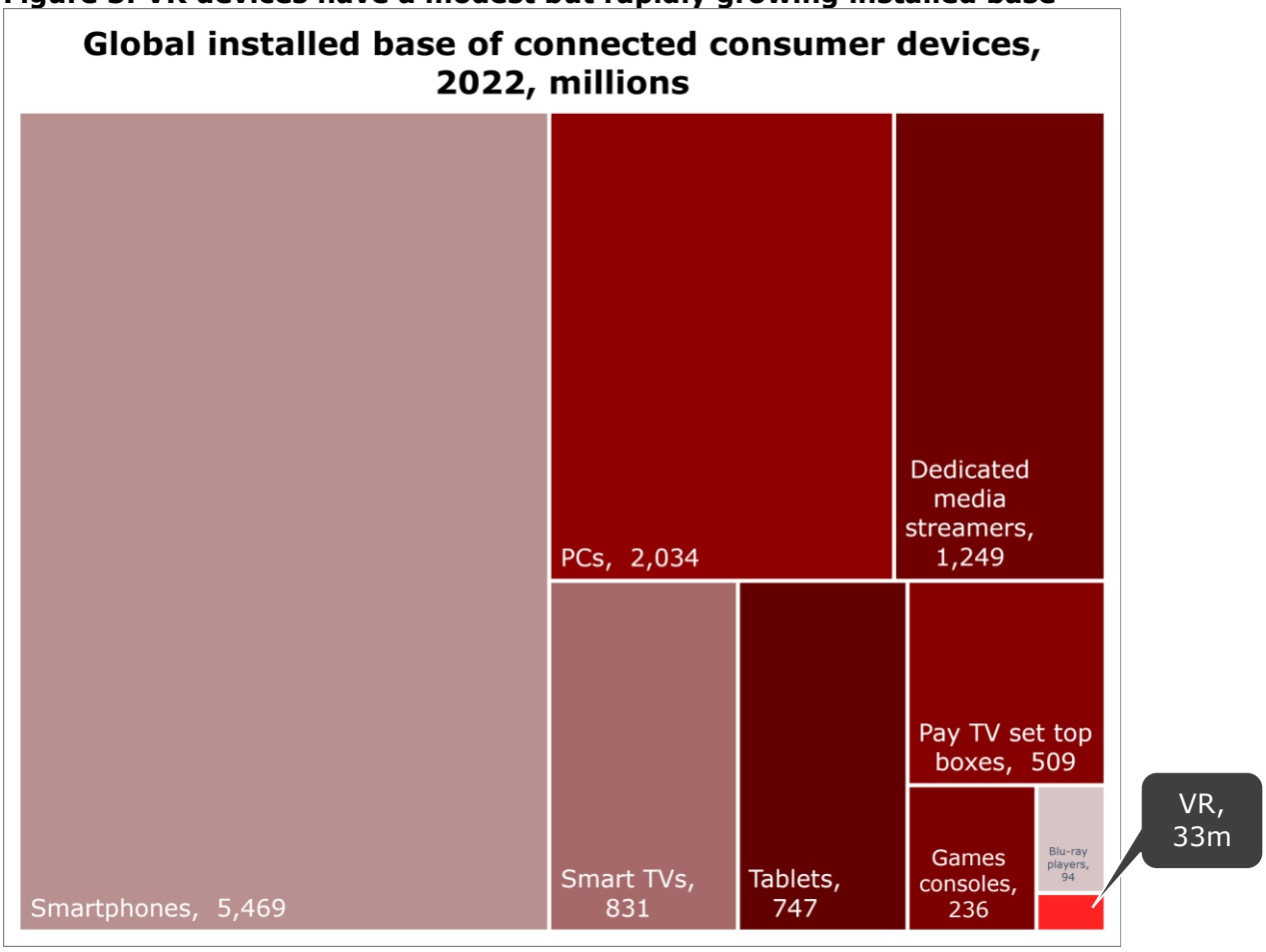
The approaching metaverse of virtual reality

2022 will not be the year that VR headsets (which, unlike augmented reality [AR], are predominantly consumer devices) go mass market. Nevertheless, the second and third generations of popular VR headsets are readily available. Recently released headsets have allowed developers to understand the potential of these devices. VR headsets will go mainstream as developers gain experience with designing for today's Magic Leap 2, Varjo VR-3, HoloLens 2, Pico G2, Oculus Quest 2, Lenovo ThinkReality A6, and VIVE Pro McLaren. By the end of 2022, the global installed base of wearable VR devices is expected to reach 33 million (see **Figure 3**). An estimated 12.5 million of that installed base will be attributed to shipments in 2022, and this figure will double again by 2026.

Adding to the complexity and network load is the growing demand for multiplayer and social VR experiences. Interest in virtual collaboration, training, education, design, and healthcare tools is growing. Thus, developers will be focused on increasing the maximum number of concurrent users and refining the interactive elements of their virtual experiences.

If an AR or VR application is layered on top of the HDV, videoconferencing, and work-at-home applications (e.g., a gamer and one or two friends are sharing a virtual 360-degree 8K video simultaneously), the user experience for all unprioritized apps will degrade quickly.

Figure 3: VR devices have a modest but rapidly growing installed base



Source: Heavy Reading, Omdia, Connected Devices Databases – Core Connected Devices (May 2022)

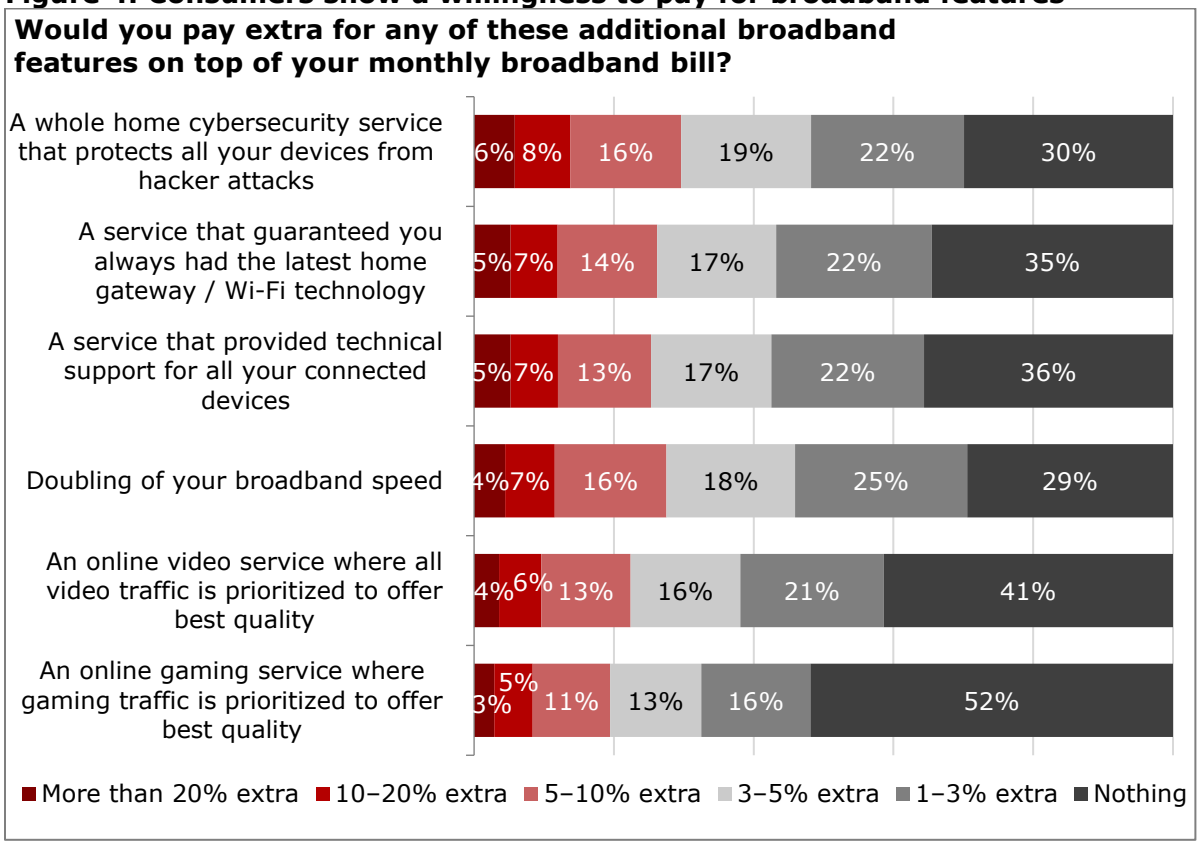
In looking at these existing and emerging applications, it is not at all difficult to visualize the demand that will drive the residential market to connectivity speeds of 1 gigabit and greater. Providing the connectivity is only the tip of the iceberg, however. CSPs must be able to tailor the service bundle, driving that demand to the needs of the individual user.

Designing for service differentiation

The pandemic has highlighted the need for higher speed and more reliable connectivity for the consumer. CSPs realize, however, that plans for the future must combine enhanced connectivity services with digital service offerings. Digital services built on connectivity and high bandwidth applications such as cloud gaming, AR/VR, over-the-top (OTT) video, enhanced security, and telemedicine are being designed and implemented today as growth strategies. By offering bundled services, CSPs look to maximize revenue, increase customer satisfaction, and reduce customer churn.

Consumers admit, begrudgingly, that they are willing to pay for additional services from their broadband provider (see **Figure 4**). The highest percentage of respondents ascribe value to doubling their broadband speed, with only 29% responding that they would not pay extra for that. Enhanced security, automatic upgrades for home gateways/Wi-Fi, and technical support for connected devices top the list. Nevertheless, 20%+ of respondents are willing to pay from 5% to over 20% extra on their monthly bill for prioritized video and gaming services.

Figure 4: Consumers show a willingness to pay for broadband features



n=10,062

Source: Heavy Reading, Omdia, Digital Consumer Insights 2021 – Smart Homes

In addition to offering a rich portfolio of enhanced broadband services, the CSPs must offer an enhanced, personalized, and simplified customer experience (CX). While carriers have leveraged AI to digitize the CX, they are now taking it a step further toward personalization. The ability to use AI and analytics to discover and act upon data-driven insights to improve speed and personalize the CX is an increasingly important aspect of doing business in today's digital world.

Using AI-powered customer engagement and experience platforms can help contextualize and personalize the CX. Personalization is becoming more of a differentiator, as consumers have increasing expectations of both speed and accuracy. CSPs should be borrowing a page from the OTT vendors' and hyperscalers' playbooks, both of which are successfully using AI and analytics to personalize the CX.

Enabling data-driven transformation

In 2022, CSPs are rethinking operating models while enjoying, and perhaps due to, unusually strong demand. Central to their thinking, and the foundation of these new operational models, are the concepts of software-defined, virtualized, and ultimately cloud native networks. The challenging mix of multigenerational broadband and RAN solutions, physical and virtual solutions, and customized and open solutions demands an orchestration solution that can operationally transform complexity into order while improving performance.

The goal of the CSPs is to implement an open, modularized, cloud native software platform that improves and simplifies network management by eliminating service and vendor siloes. These solutions must automate the lifecycle management of any network slice, service, or application. In addition, CSPs need the flexibility to run their management functions in the public cloud, as well as their own telco clouds, to benefit from cloud agility, scale, and economics. Finally, such solutions must empower CSPs to own, design, and maintain their own services in a scalable and cost-effective manner. They must ensure that new services specifically tailored to subscriber use cases such as low latency VR gaming, ultra-reliable telemedicine, and secure enterprise transactions can be quickly designed and deployed to exploit new use cases as they appear and drive customer satisfaction and loyalty.

Such a solution entails an extensive partner ecosystem that, in turn, requires a commitment to standards and support for open APIs. Vendor-agnostic network orchestration has been the holy grail, the quest of the CSPs, for over a decade. Today, by leveraging advanced automation, data analytics, and service management—and with the example of the hyperscalers to provide a somewhat of a path—the goal of the "single-pane-of-glass" orchestration system is within reach of the CSPs.

Investing in the customer experience

The CSPs' top priority for digital transformation is the CX. Investing in CX brings improvement throughout the value chain, including service optimization, higher Net Promoter Score (NPS), lower customer churn, fewer truck rolls, a decrease in customer support calls, new revenue opportunities, and of course, an increase in the average revenue per user (ARPU).

That is a transition the CSPs will struggle with if they go it alone. The volume, diversity, and complexity of network data, the need for end-to-end vendor-agnostic service assurance and automation, data analytics, AI, and Wi-Fi experience management—all at a monumental scale—make it clear that CSPs will need partners to reach their goals in a timely manner at the scale needed.

CSPs have moved from a network technology focus to a more data-centric philosophy. However, they can become more competitive and more in tune with their subscribers by aiming for a customer-centric network. They can continue to measure performance by delay, jitter, and packet loss. But they can also measure their success by the quality of an HD video conference, a gaming app, or a remote healthcare app and by a highly personalized and immersive subscriber experience.