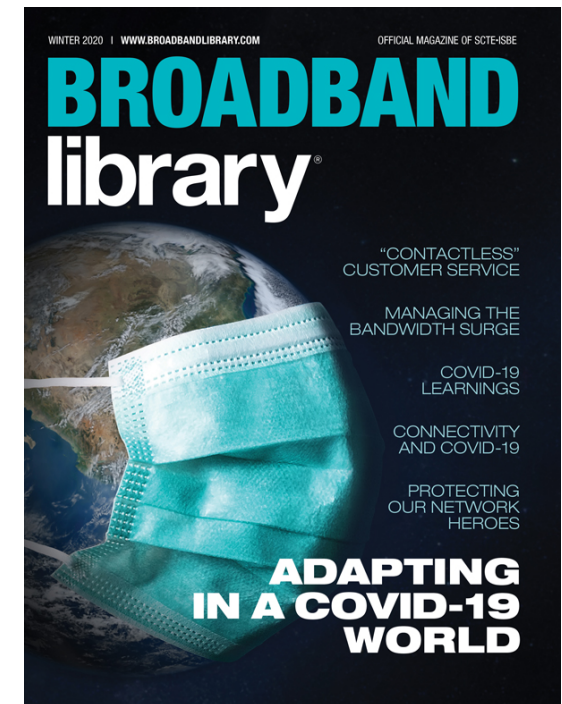


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Connectivity and COVID-19

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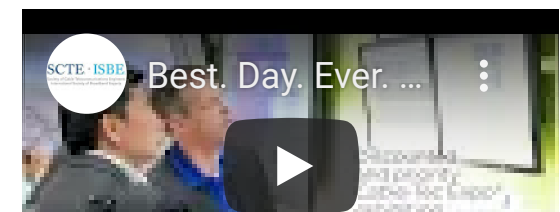
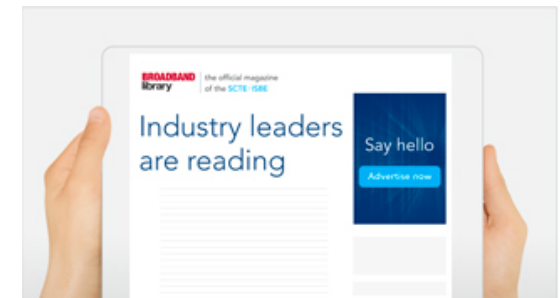
By Bill McFarland

Maintaining QoE during a crisis

Few events in modern times have impacted society as significantly as COVID-19. Across the globe, working and learning from home became “the new normal” as governments mandated social distancing and sheltering-in-place. Not surprisingly, the environment for service providers (SPs) has changed.

The dramatically increased Internet usage, loads, and sensitive traffic in homes have challenged SPs’ ability to provide sufficient quality to consumers. Not only are more people using the Internet at home at all hours — both for work and entertainment — but they’re connecting more devices to their home network and creating higher demand due to streaming and videoconferencing.

These changes will persist after COVID-19 restrictions lift. Of the more than 8,800 people Accenture recently surveyed¹, 53 percent of those who’ve never worked from home planned to do so at least part of the time in the future. Remote work will likely remain a trend, now that many businesses have discovered that technology brings new possibilities to what constitutes “the workplace.”



For SPs, these trends create both challenges and opportunities to differentiate. Using technology, they can mitigate the effects while improving customer experiences and offering new services to compensate for revenue losses.

The effects of COVID-19 on user behavior

When the shelter-in-place mandates began, concerns arose over whether broadband providers could meet the higher demands. Some OTT streaming services even reduced their quality to help with the anticipated bandwidth issues.²

Indeed, SPs saw a considerable shift in patterns. Comcast reported a 210–285 percent surge in videoconferencing and VoIP traffic and a 20–40 percent increase in streaming and web video consumption.³ Additionally, as of mid-May, Comcast noted peak times for downloads shifting from 9 p.m. in most cities to 7:30 p.m. Peak uploads shifted from 9 p.m. to between 8 a.m. and 6 p.m.

Plume data shows similar changes.⁴ We found the number of households active online during regular work hours grew by 105 percent in 14 key metro areas, but Internet speeds delivered to the router remained consistent with pre-pandemic numbers. Average speeds even trended upward because subscribers upgraded to higher-tier services to meet expanded needs.



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The story within the home, however, is different. That's because the majority of devices in homes connect over Wi-Fi, and Wi-Fi has the fundamental problem of being a shared medium that struggles with increased loads. In fact, we found an increase in the amount of data consumed by phones, computers, and entertainment devices, as well as the number of minutes these devices were active on the network and the times they were active and overlapping.

This "wireless chaos" inside the home leads to unhappy customers who feel their SPs don't offer adequate network quality. But consumers aren't actually interested in network performance — they care about the quality of experience (QoE). And SPs need to measure this new metric.

Moving from QoS to QoE

Traditionally, carriers have used quality of service (QoS) to measure customer satisfaction. Factors that impact QoS metrics include signal strength, data rate, and congestion/interference, which indicate the network operation quality. To accurately reflect consumer satisfaction, SPs need to look at QoE instead.

QoE starts with similar factors as QoS, but also takes into consideration the devices and services that customers are using in their homes. As well as factoring the specific needs of each type of device or service, the QoE metric includes many conditions beyond signal strength, data rate, and congestion — such as packet error rates, historical usage patterns, and the complete data path, potentially through multiple hops, between the device and the Internet.

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Consider this. A customer with a Wi-Fi thermostat that receives reliable 1 Mbps service will be perfectly happy. On the other hand, a customer with a 4K set-top box that receives 20 Mbps service is likely unhappy. But traditional QoS mechanisms would predict the opposite: the Wi-Fi thermostat would be thought to be struggling, and the set-top box would be considered healthy.

Consequently, SPs may spend money trying to fix IoT-related “non-problems” with steps like additional repeaters, while other customers continue to have poor streaming experience and churn to a different SP.









Other effects on the home network

SPs need to understand four other problems impacting the home network. Each of these can be mitigated with technology.

Demands on coverage

When customers have trouble connecting to their home network, it’s usually due to inadequate signal strength to and from devices at locations within the home. Homes often have “dead spots” — regions not covered well by Wi-Fi service — and behavioral changes due to COVID-19 have exacerbated this problem. As multiple people in the household seek areas for working and learning in privacy, they are more often using home regions with poor coverage.

Deploying multiple hops in an optimized topology can dramatically increase throughput, but this isn’t common because choosing and configuring an

optimized topology is complex. Cloud technology enables sophisticated solutions. An adaptive Wi-Fi system using rigorous optimization approaches, such as mixed integer linear programming (MILP), can maximize throughput to individual devices, overall home system capacity, and fairness among the devices in the home.

Optimized steering

Multi-AP systems create problems related to where devices connect into the network. Some manufacturers use “sticky client steering” — if a device gets stuck to an access point (AP) while the user moves to a far side of the home, the sticky device is kicked off the AP and forced to search for a closer one. While this is better than nothing, these connections aren’t optimal. To improve that connection, an optimizer used as part of client steering calculates the prime location for the device, identifying where the device performs best and eliminating excessive hops that degrade performance. As the device moves around and attaches in inappropriate places, the results from the optimization are applied to client steering to connect the client to the best location.

Increased interference

Increased usage due to COVID-19 causes additional interference (overlapping transmissions from neighbors) and congestion (self-interference from other devices within the home). This is particularly a problem in multiple-dwelling units (MDUs) such as apartment complexes. Sophisticated cloud-based processing can solve this.



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This is how it works: The APs report statistics about neighboring APs along with interference levels and traffic loads. Based on the lists of neighboring APs, a clustering algorithm, run in the cloud, forms groups of APs that are tightly coupled to one another. An optimizer then selects frequency channels and bandwidths to maximize the performance of the entire cluster.

Cybersecurity concerns

Cybersecurity experts often say that bad actors take advantage of chaos, and this was evident during the pandemic. Cybercriminals leveraged fear, confusion, increased Internet use, and remote work to up the ante on cyberattacks and phishing campaigns.

Cybersecurity company Check Point found that coronavirus-related attacks grew to more than 200,000 per week in late April, compared to less than 5,000 in February.⁵ Anonymized data from a sample of households using the Plume Cloud also showed that 87 percent of homes experienced some type of cyberattack.

A robust cybersecurity system that includes layered protections at every node — not only at the gateway or main router in a home — can mitigate this risk. Advanced techniques like machine learning can augment some of the more basic protections. For example, machine learning helps detect anomalies in port connections or in IoT device behaviors that may be caused by malware.

Identifying opportunities

Like other industries, carriers saw significant financial impact. New technologies can help in at least two areas: the costs of customer support and additional revenue from new services.

For example, machine learning can help predict which customers are most likely to call for support based on networking conditions and usage patterns. This predictive capability could be applied for sending preventive emails and providing proactive maintenance or care.

Ideas for new revenues include using Wi-Fi motion detection for home physical security and elder care. The motion system would set off an alarm when motion is sensed or not sensed, respectively. Future versions of the technology may even be able to detect falls and quickly turn on lights as someone enters a room.

Recovering from the effects of this crisis will take time. To adapt to this new world, SPs need to innovate. By using technology, they can demonstrate their commitment to service, improve customer experiences, and grow their revenue streams.

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Bill McFarland,

CTO, Plume

bill@plume.com

Bill McFarland is the CTO of Plume. He leads projects in data science, optimization, standards, intellectual property, and regulatory matters. Previously VP of Technology at Qualcomm, and the CTO of Atheros Communications, Bill holds over 80 patents and has authored over 35 technical papers. He received a Bachelor's Degree in Electrical Engineering from Stanford University and a Masters Degree in Electrical Engineering from the University of California. Bill was elected fellow of the IEEE in 2014.

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