

RCR Wireless News

INTELLIGENCE ON ALL THINGS WIRELESS

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Building a future-ready rural broadband infrastructure

By Kelly Hill

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Last year, Terry Young ran across a photo on a World Economic Forum web site that showed an empty classroom - magenta-painted metal chairs and tables filling a room that, like many around the world, had been emptied of students because of the Covid-19 pandemic.

It struck her, she recalls, because “it captures the feeling that people have now about what it means to be unconnected. It means that you can no longer have your children educated. You can maybe no longer get medical services. [Broadband is] much more critical, and [the pandemic] really put a focus on it.”

Young, who is director of service provider and 5G product marketing for A10 Networks, sees the intense focus on expanding broadband networks as one of the few good things to emerge from the pandemic. It’s happening around the world, as governments seek to mitigate the educational, social and economic fallout of the pandemic. “This is a global phenomenon - it’s not just the U.S.,” says Young. “Everywhere in the world, the pandemic has put the spotlight on where the digital divide is, and who’s on which side of it, and how many unconnected people there are.”

While there are multiple global efforts to bridge the digital divide as a response to the pandemic and the impulse to turn to communications technologies, including 5G, for economic stimulus to drive post-pandemic economic recovery, the amount of money that the U.S. federal government is lavishing on various aspects of broadband services is particularly large, with the ambition to finally close the divide once and for all. The Biden administration has proposed as much as \$100 billion to provide broadband to every home and business in America, with a heavy emphasis on fiber.

One of the biggest barriers to closing the digital divide has long been cost - it simply costs too much, network operators have said, to put in the infrastructure and the return on investment takes too long or is simply non-existent.

Now there are billions of dollars being thrown at that problem. If capex cost is no longer an issue, what challenges remain? And which ones can’t be solved by cash alone?

This report explores key considerations facing rural operators as they navigate a massive influx of funding during a time of multiple network technology transitions,



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and how operators are strategizing to make the highest and best use of those tax dollars in the context of total cost of ownership (TCO).

Broadband Funding, Everywhere

To give a sense of the scale of funding and the many potential wells from which network operators can draw, here are some highlights of recent federal broadband

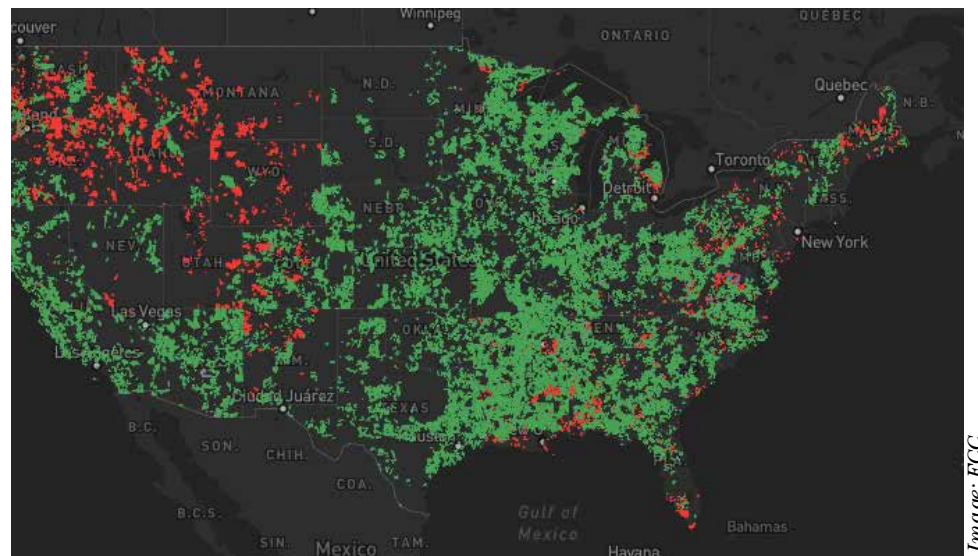
funding efforts, both passed and proposed. (This is not an exhaustive list and does not cover individual state plans or funding.)

The **Rural Digital Opportunity Fund** reverse auction for Universal Service Fund support the coming decade wrapped up last December; the FCC is still reviewing the long-form applications of the presumptive winners. RDOF's first phase awards \$9.23 billion in support of high-speed rural broadband deployment, with service tiers ranging from a minimum of 25/3 Mbps and up to gigabit speeds. The FCC said that the funds will be used in 49 states and one territory to connect nearly 5.3 million locations in 61,766 eligible census block groups. The commission says that winning bids to deploy downlink speeds of at least 100 Mbps cover 99.7% of the locations, with more than 85% covered by bids promising to deliver gigabit-speed service. Those deployments will come as a combination of wireline, fixed wireless and space-based internet service, as Elon Musk's SpaceX has won nearly \$886 million in support of its low-earth-orbit satellite service, Starlink - although Starlink's RDOF dollars have drawn critical

eyes from observers who wonder if the company, which is still in its beta phase of service provision, can actually live up to its performance commitments and service customers across the 35 states where it won RDOF funding. There were 180 winning bidders in the RDOF auction, out of a field of nearly 400 qualified bidders; the other top winning bidders included LTD Broadband, Charter Communications and the Rural Electric Cooperative Consortium. LTD Broadband is a fixed wireless internet service provider that says it has 1,800 tower sites in Iowa, Minnesota, Nebraska, South Dakota and Wisconsin covering over 50,000 square miles which is

the fourth-largest WISP in the U.S. LTD won \$1.3 billion in support over 10 years to build out fiber and wireless broadband in 15 states. Charter won \$1.2 billion in support to build out fiber and cable networks in 24 states, and the Rural Electric Cooperative Consortium won \$1.1 billion over ten years to build out fiber connectivity in 22 states. RDOF will have a second phase of funding in the future, awarding additional money for a total of up to \$20.4 billion in the two phases.

The \$2 trillion **Coronavirus Aid, Relief, and Economic Security (CARES) Act**, which was the initial Covid-19 relief bill passed in 2020 under then-President Donald



An FCC map of RDOF winning bids. Green represents gigabit-speed bids and red means service of at least 100/20 Mbps will be deployed.

Image: FCC

Trump, focused largely on supporting businesses and individuals through the pandemic. It also provided \$100 million for USDA's rural broadband **ReConnect program**, and \$200 million to the **FCC for telehealth-related grants**. In addition, the bill provided \$150 billion to state and local governments, some of whom opted to pump a portion of that money into broadband or connectivity-related efforts during the pandemic. Ohio, for example, set aside \$50 million that it received through the CARES Act to fund purchases of hot spots and internet-enabled devices for students. CARES Act funds were initially meant to be spent by the end of 2020, but Congress has extended the deadline for using the funds through Dec. 31, 2021.

The **American Rescue Plan**, signed into law by President Joe Biden in March, is a \$3.2 trillion relief package that included about \$7 billion for various broadband-related programs. That figure includes the \$3.2 billion **Emergency Broadband Benefit program**, which provides subsidies of up to \$50 per month for broadband service (up to \$75 per month on Tribal lands). The FCC had more than 1 million households sign up for the

program within its first week. The bill also included \$1.9 billion for a rip-and-replace program for Chinese equipment that the U.S. government deems a network security risk; \$1.3 billion for **NTIA**, including \$1 billion for tribal governments to use on broadband deployment, telehealth, distance learning and other digital initiatives and \$300 million to support broadband infrastructure deployments in unserved locations, especially rural areas. It also includes \$285 million to support a pilot program for broadband around historically Black colleges and universities, and the surrounding communities, \$250 million for the FCC's Covid-19 telehealth program and \$65 million to implement the Broadband DATA Act to improve the accuracy of broadband deployment data. America Rescue Plan funding is available to be used through the end of 2024.

That \$150 billion in the CARES Act plus another \$350 billion in state support from the American Rescue Plan is being disbursed by the **U.S. Treasury Department**; the American Rescue Plan specifically allows for states to use the money "to make necessary investments in water, sewer or broadband infrastructure." The Treasury Department is

also administering a separate, \$10 billion **Capital Projects Fund** for states, territories and tribal governments for capital projects and "the ancillary costs needed to put the capital assets in use," for projects that are "critical in nature, providing connectivity for those who lack it," the Treasury says, adding that the Capital Projects Fund "allows for investment in high-quality broadband as well as other connectivity infrastructure, devices, and equipment." The agency will begin accepting applications for review this summer.

In addition to the funding that has already been passed, there are multiple proposals for even more broadband investment. These include:

The American Jobs Plan, Biden's infrastructure and job stimulus package that is still in negotiations, includes \$100 billion for additional broadband investment. That "historic investment" plan for broadband lays out the lofty goal of providing "affordable, reliable, high-speed broadband to every American" and hits on cybersecurity as well; award recipients under the act will be asked to source from "trusted vendors" and "give preference to open, interoperable architecture where feasible,"

which could be a boon to domestic Open RAN efforts. It also includes a billion dollars for modernizing the federal government’s networks and technology use. “As important as the plan itself is the message it sends - that broadband, like electricity, is a necessity, and that one cannot participate in our economy, our education and health care systems and our society without it,” said Gigi Sohn, a fellow at the Georgetown Institute for Technology Law and policy, and counselor to former FCC Chairman Tom Wheeler, in a blog post in response to the American Jobs Plan. “The United States cannot afford to be a country of digital haves and have-nots.”

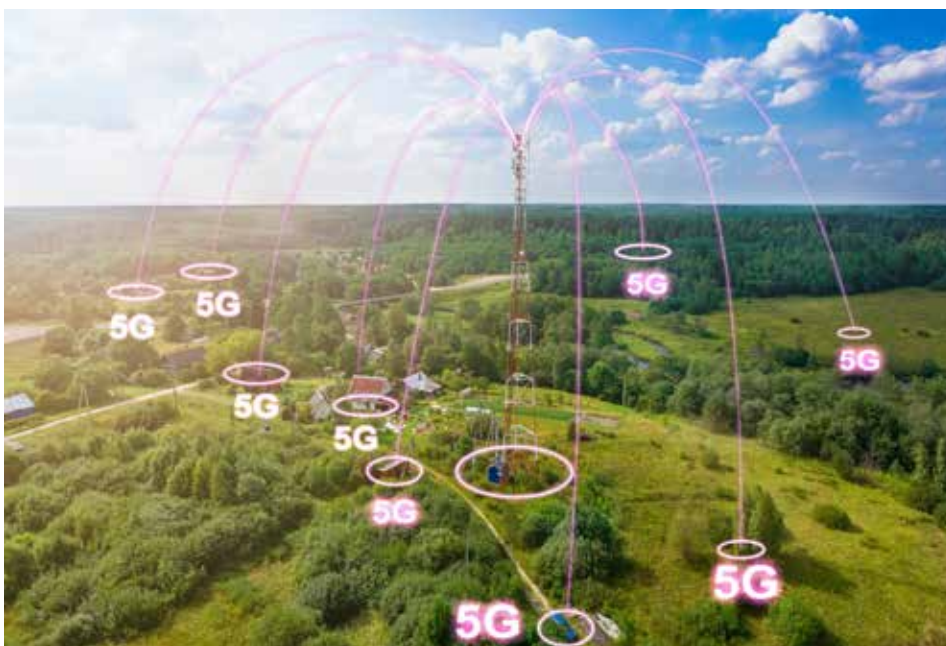
The LIFT America Act, introduced by 32 House Democrats, asks for \$80 billion to deploy “secure and resilient high-speed broadband” access across the country to unserved and underserved rural, suburban and urban areas, which they say will “allow for 100% broadband deployment throughout the nation.” That proposal also includes \$15 billion for implementing NG911 services, \$5 billion for low-interest broadband financing, and \$9.3 billion to lower the price barriers to broadband affordability and adoption.

Also on the horizon for wireless network operators is the Rural 5G Fund, which the FCC authorized

in late 2020, which would provide about \$9 billion in USF funding over ten years to bring 5G to rural areas. This is the first USF program that is expected to be able to incorporate data from the FCC’s Digital Opportunity Data Collection proceeding to improve the accuracy of network mapping data. The first phase of the auction will involve up to \$8 billion for “areas lacking unsubsidized 4G LTE or 5G mobile broadband,” with \$680 million specifically set aside for bidders offering to serve tribal lands. The second phase will provide at least another \$1 billion, plus any unawarded funds from the first phase, to “specifically target the deployment of technologically innovative 5G networks that facilitate precision agriculture.” The FCC said it plans to include an adjustment factor in the Rural 5G Fund reserve auctions to ensure that the hardest-to-serve areas can compete in the auction. Winning bidders will be required to provide 5G mobile broadband at speeds of at least 35/3 Mbps.

Networks are in flux

A large amount of the funding outlined above will flow to network operators and consumers in the short- and medium-term, fueled by the



urgency of broadband needs during the Covid-19 pandemic as well as the desire to close the digital divide once and for all. That money will be hitting telecom networks, both wired and wireless, which are already in transition on a number of fronts. That means both new challenges and new opportunities opening up in these transitions, including:

- The generational shift from 4G to 5G, which is a fraught undertaking all by itself. New spectrum bands are coming online for 5G that demand more site density, even in the midband; 5G may offer up new revenue streams for regional operators in the form of private networks, support for billions of IoT devices and precision agriculture services. But any upgrade of this magnitude comes with significant cost and complexity.

- The proliferation of fiber, which is influenced in part by the move to 5G and increasing demand for speed, capacity and low latency. While the last-mile access technology for broadband may be mobile or fixed wireless, fiber is still, for most providers, the preferred technology for the veins of the network.

- The shift to virtualization, and the accompanying interest in Open

RAN initiatives. In recognition of the opportunity that cloud use plays in rural America—where many farm and factory IoT solutions are being deployed—the Rural Cloud Initiative formed last year. “Paramount to closing the digital divide is the ability to bring cloud native networks to the rural carrier in a cost-effective manner,” said Venky Swaminathan, CTO of Trilogy Networks, which is spearheading the RCI, which brings together around 65 network providers, edge technology partners and application providers and has already put together its first “farm of the future” technology showcase. Trilogy Networks

operates a nationwide private network and works with rural network providers to move their traffic around the country. According to Swaminathan, “The goal is really around how we can bring the next generation of applications to this marketplace” through partnering with network operators and other rural technology providers who can provide physical locations for edge computing resources, and bringing them together with other tech and application providers to provide tailored solutions for the rural market. Participants in RCI include network providers Inland Cellular of Idaho, Pine Belt Communications



A telecom tower in California.

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IPv4: Running Out of Capacity?

Somewhere between 22 and 43 million Americans are without adequate broadband service. But an operator building out to just 10,000 new subscribers could spend \$320,000 for IPv4 addresses. IPv4 can add 15% to an already strained budget.



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of Alabama, United Wireless of Kansas and more; its edge innovation partners include Intel, edge company Vapor, open RAN specialist Altiostar and satellite operator Intelsat, among others.

• Network security concerns are increasing, both in terms of national security and specific threats. The U.S. government under Trump took a hardline approach to China and Chinese companies supplying network equipment and services, but the Biden administration has shown no interest in softening that position when it comes to equipment vendors such as Huawei and ZTE. A new executive order in early June 2021 expanded the scope and framework for prohibiting U.S. investment in Chinese companies which are related to China's "defense and surveillance technology" sectors, and that EO explicitly identifies Huawei as part of China's "surveillance technology sector" as well as prohibits investment in a range of Chinese tech companies including all three of its major mobile network operators. The federal government has now officially funded the \$1.9 billion for replacing Chinese vendors' equipment in U.S. telecom networks, and the FCC has completed its list of acceptable

equipment - so those federally required changes to legacy networks are coming, even if the exact timing is uncertain.

Meanwhile, the FCC continues to combat robocalls through the STIR/SHAKEN framework and the

implementation of the TRACED Act, the latter of which requires all voice carriers to eventually implement the ability to authenticate caller ID information and prevent call spoofing, one of fraudulent and scam robocallers' favorite

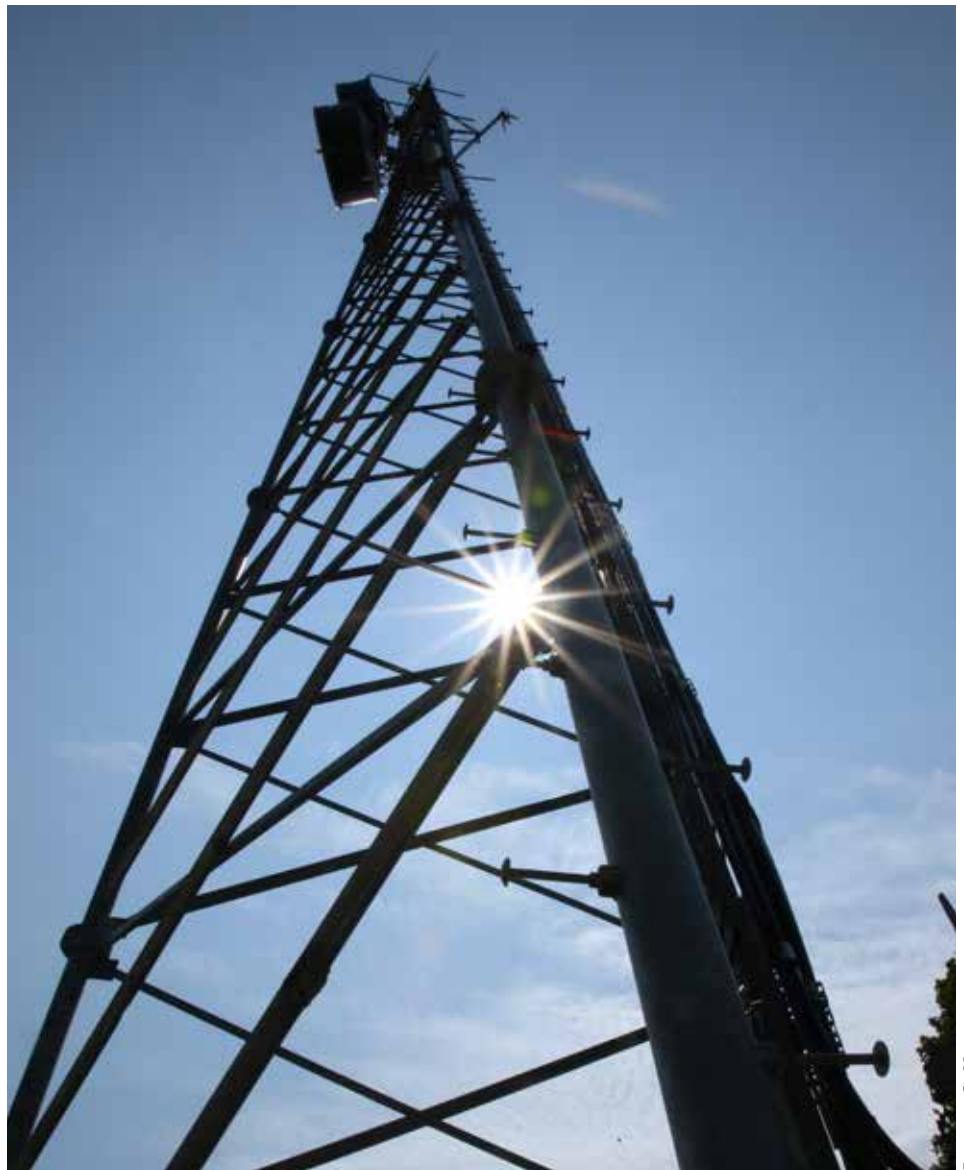


Image: Cellcom

tactics. The original deadline for all carriers was June 30, 2021, but the FCC has granted an extension to providers including small, rural voice service providers with fewer than 100,000 subscriber lines, so long as they implement a robocall mitigation effort. However, every carrier must by June 30 provide information to the Robocall Mitigation Database of the FCC's Wireline Bureau, including details about the extent to which they are signing traffic with STIR/SHAKEN or otherwise preventing robocalls. As of September 28 of this year, intermediate providers and terminating voice traffic providers will not be required to accept traffic from voice providers who aren't in that database.

In addition, recent cyber attacks on major infrastructure providers, including the largest U.S. pipeline system and a major meat producer, have raised additional concerns about the shifting threat landscape - one that both rural operators and newly connected customers will have more exposure to as they expand. And the Covid-19 pandemic also drove a massive and rapid shift in Dedicated Denial of Service (DDoS) attacks around the world: As digital services became

more vital, they also became targets. Network monitoring company Netscout reported that it observed a record 10 million DDoS attacks in the second half of 2020, and the lessons it distilled from the resulting data are pretty bleak: Even as the world grappled with the impacts of a global pandemic, cybercriminals were taking advantage of end users without enterprise-grade security and targeting online services that people were depending on, such as e-commerce, online learning, streaming services and healthcare. Netscout reported a "huge upsurge in distributed denial-of-service (DDoS) attacks, brute-forcing of access credentials, and malware targeting of internet-connected devices. ... We observed multiple record-breaking events: the most DDoS attacks launched in a single month (929K), the most DDoS attacks in a single year (more than 10 million), and monthly DDoS attack numbers that regularly exceed the 2019 averages by 100,000 to 150,000 attacks."

"Operators have not necessarily taken advantage of all the tools that are out there, and they need to double down more on some of the basic security," says AI0's Terry Young.

"I think the same is true

of some of these operators who are introducing new subscribers to a whole new environment, and they're expanding the wide, wide world of broadband access - and threats - to communities that maybe haven't had to deal with it before. There may be a whole learning curve on trying to get more up to speed on all the ways you can be attacked," she adds - for operators, consumer and rural enterprises as well. Young notes that small hospital locations have been among specific targets of cyberattacks during the course of the pandemic, and Covid-19 related scams (robocalls, phishing and other tactics) have proliferated rapidly as well.

- One of the other, long-standing transitions that nonetheless has implications for newly connected rural customers is the transition from IPv4 to IPv6 internet addresses, first permanently implemented back in 2012 as the world anticipated the accelerating number of internet-connected computers and eventually, IoT devices. (If you think of an IP address as having four segments, those are IPv4 addresses; IPv6 addresses have eight segments.) "The basic dilemma for most operators is that it continues to be a very mixed environment - you may have customers

who have very old legacy CPE, you have service providers who may have older technology that is still very functional within their data center, and then you have the websites that subscribers are trying to get to,” Young explains. “Even though many, many of the large content providers support IPv6, there’s tons of websites that are IPv4-only and if you want to provide connectivity to

everywhere you have to be able to support both” - because the two are not backwards-compatible. Service providers have to be able to translate back and forth between the two in order for users to have a smooth experience. “IPv6 adoption keeps increasing. Everyone is moving in that direction,” Young says. “But in the meantime, you’ve got this mixed environment that has to be addressed.”

While operators often have an existing base of IPv4 addresses that they have been assigned, expanding services to tens of thousands of new customers and devices can deplete them. “They are probably going to run out, if they’re trying to extend service to that ten thousand, fifteen thousand, twenty thousand, forty thousand - however many subscribers it might be as they build out to these new areas,” Young says. “So for those operators that have an exiting investment in IPv4 and cannot immediately move to IPv6, they have to either acquire more IPv4 addresses or find a way to use what they have more efficiently.” This factors into build-out costs and TCO, she points out, offering up some rough math: IPv4 addresses, which are now scarce and in-demand, can cost up to \$32 apiece, she says. For 10,000 new subscribers, that’s a cost of \$320,000. She gives another data point: The FCC’s RDOF program of \$9.2 billion aims to cover an additional 5.2 million premises, or nearly \$1,800 per home. “\$32 might not sound like much, but it’s 1-2% of the total spend for that subscriber. That’s 1-2% that they could use for something else,” Young says.

So given the complex environment in which networks are evolving,

A sampling of IPv6 deployment measurements

How far along are network operators around the world on deploying IPv6? Even for large carriers, the figure varies widely. According to the World IPv6 Launch, a measurement project of the Internet Society that includes measurements of IPv6 deployments for participating network providers around the world, global IPv6 traffic has grown more than 5,000% since World IPv6 Launch began on June 6 of 2012. Now, nine years later, some networks are reporting deployment figures as high as 80 or 90%. The IPv6 measurements below were recorded as of May 12, 2021.

Comcast:	72.38%	Liberty Global:	17.77%
T-Mobile US:	91.39%	Google Fiber:	42.75%
AT&T:	71.82%	NTT DoCoMo:	11.12%
Verizon Wireless:	83.73%	China Mobile:	44.70%
Combined US mobile network operators:	86.80%	Centurylink:	0.15%
Charter Communications:	53.01%	China Unicom:	21.66%
Cox:	60.34%	China Telecom:	11.17%

what does a “future-ready” network look like? There isn’t necessarily a lot of consensus, even at the federal level, and to some extent the goal posts are always moving. Would it be a 5G network? A fiber network? How fast is it, and what latency or other KPIs should be expected? The patchwork of funding programs also represent a patchwork of performance requirements. CAF 2 build-outs, for example, which require a minimum of 10/1 Mbps, are still being completed even as RDOF pushed service tiers up to gigabit speeds. The Biden administration appears to believe that all Americans should have high-speed wired network access, as the maps and numbers that the administration has presented have been pared down to only include cable and fiber (not mobile broadband, fixed wireless or satellite service). “Clearly in government policy now, the goal is, we’re trying to get to gigabit,” says Claude Aiken, CEO of the Wireless Internet Service Providers Association. RDOF reflects that new goal, and the Rural 5G Fund also reflects the FCC’s priority that rural areas not be neglected as mobile network operators transition to 5G. Carol Matthey, founder of Matthey Consulting and former deputy chief of the

Wireline Competition Bureau of the FCC, who led the development of CAF, points out that while the FCC’s view of what should be considered “broadband” speeds has changed over time, “the FCC’s objective for these programs has been to focus on the areas that lack service, as opposed to working on upgrading the areas that have some service, to faster service.” So let’s hear from some network operators who are providing services and how they’re navigating the shifting landscape.

Nsight/Cellcom: ‘It’s going to be a little chaotic’

Brighid Riordan is the CINO and VP of Emerging Services and Public Affairs for regional telecom

company Nsight, which operates the Cellcom wireless brand serving customers based in Wisconsin and Michigan’s upper peninsula. The company’s history dates back to 1910 as a telephone service provider, and it has operated its Cellcom wireless brand since 1987. Riordan’s family has been involved with the company since 1923, so she watches the industry evolve from a perspective that is informed by several generations. She says that all of the money flowing into broadband network right now—both wired and wireless—is almost like a puzzle, with the challenge being to figure out where the money is coming from, how it can be used and what part it will



Image: Nsight

play in Nsight's decisions. Capital expenditures for network build-outs has been a "huge stumbling block, it is absolutely the truth," she says. But there are new challenges that come with a funding and competitive environment that she describes as "a little bit more Wild West." And like the old West, "unfortunately, it is going to bring out some new dishonesty and some territory grabs, and it's going to be a little chaotic."

She sees two problems facing broadband, one of which is often forgotten: The first being people not having reliable access to broadband, or any broadband at all, and the second one being consumers' willingness to pay for service. If you're trying to fix the second issue, "you're chasing a different problem" than access, she points out. "I think what people are chasing, at least in our state, is it doesn't matter which problem it is, we're going to fix both somehow. I think the investment is good and has the potential to fix the capex problem. My concern is that it's not going to be uniform, consistent, structured in a way that makes best use of the dollars and gets the problem fixed."

She also points out that even within the same state, the difference

between federal and state funding can mean significant differences in implementation. And when it comes to legislation, small turns of phrase—like the difference between "up to" a certain speed or "a minimum of" that speed—make huge differences in what it means for a network operator to build out. She said that Nsight believes that fiber is the best option for its wireline network. "When we look at solving the broadband problem, I know there's a few different opinions, but certainly the most reliable, future-proof is fiber. But the government has funded a variety of things up to this point, so you're looking at a mishmash of services."

In Riordan's view, though, there has been a major, recent change in what is considered the go-to technology for rural broadband. "If you asked any of us at our company two, three, four years ago, 'How is broadband going to be deployed to rural areas?', we would say, 'Wireless. It's going to be wireless from here on out. That's going to be the solution. ... That has changed with the infusion of capital [from the federal government.]" She expresses some reservations about whether all of America could be connected via fiber-to-the-home



"The business models are extremely complex and there is a lot of risk embedded in this. I hope that the government sees that just throwing the money isn't necessarily going to solve the issues."

Brigid Riordan, CIO, VP of Emerging Services, Nsight

and how long that would take, but somewhere along the line, in what she calls a "leapfrog moment," that has become at least a possibility. "I feel like that leapfrog has taken place over the last few months and I think the pandemic has certainly spurred that."

She credits both funding and, in part, new companies trying out different technologies in wireless - even if the things that they tried



A Chambers Island cellular tower for Nsight

Image: Nsight

perhaps have been expensive, or not quite lived up to the reliability or speeds that were hoped for. Nsight has been trying new technologies as well, like piloting CBRS, which Riordan says finally made it possible to get decent reliability and speeds. “That technology is really new - it wasn’t available before,” she notes. Nsight doesn’t consider fixed wireless speeds of 25/3 Mbps to be future-proof, she says, so it is testing 4G LTE CBRS at 100/10 Mbps speeds. But geography and line-of-sight still trumps technology. While she says Nsight will do more CBRS deployments (and expects to eventually use 5G in the spectrum) and there’s a place for fixed wireless, “the most successful examples of that that I see really depend on the topography. So if you’re able to get up high and shoot down to something low, you’re golden” - if there are no trees. Which is rarely the case in most of Wisconsin, she points out wryly.

While the pandemic and the amount of money flowing into broadband is resulting in heightened interest in operating networks, Riordan is quick to say that the intricacies of day-to-day operations and TCO get complicated very quickly - and more money isn’t

always going to solve them. “What I see, working with every different county, township, village, they all have a different perspective and they’re all approaching it in a different way. Some counties or entities are saying, ‘We think we want to own this, we think that’s what makes best fiscal sense for us.’ And I say, ‘Please, let people who know how to run a broadband company do that, because you’ve got bills, you’ve got callers, you’ve got installation - there’s so much more to it’ both in terms of complexity and cost. Monitoring the network is a 24/7/365 job, and even adding a new module in the billing system requires a new algorithm to be put in to make it happen. Nsight also makes a point of having live customer care. “I know not everybody does that, but it’s important to us, and we think it’s important to serving customers. We have no bots on social media, we have no bots in email and we have live people answering the phone as well....There’s just so many, so many things. And then beyond that you still have to market. This isn’t a gimme. This isn’t, ‘we’re going to give you all this money and you don’t have to worry about marketing yourself’ ...

there is competition. I don’t know if [government] understands the risk we’re still taking.” Riordan recalls times when Nsight decides to start piloting or serving a new area and a local incumbent abruptly decides to upgrade the single-Mbps service it had been allowing to languish. Nsight has ILEC territories as well, where it is the provider of last resort, and it sees competitors come in and “cherry pick,” Riordan says - which in rural areas might mean that a competitor decides to only serve the slightly-more-dense areas that enable the very remote areas to be serviced at all. In addition, when it comes to funding programs Nsight is punished, she says, because it already provides speeds greater than 25/3, precluding it from participating in some programs that benefited instead operators who had let their speeds lag. “The business models are extremely complex and there is a lot of risk embedded in this. I hope that the government sees that just throwing the money isn’t necessarily going to solve the issues. It’s got to be coordinated,” Riordan says. “I think everybody has the right intentions,” she concludes. “If this were easy, it would already be done.”

How MidCo is approaching network deployments and operation

Sioux Falls, South Dakota-based Midco is a regional service provider that serves about 400,000 customers in five states. The company is a joint venture of Comcast and Midcontinent Media and provides cable, internet (including gigabit speeds) and telephone services in the Dakotas, Minnesota and parts of Kansas and Wisconsin. Midco



“It should be seen as an enabler, all of these funds. And that means, maybe even more than ever, that you should be wise about it and build off what you already have and not scale beyond your means.”

Jon Pederson, Chief Technology Innovation Officer, Midco

participated in the recent Rural Digital Opportunities Fund (RDOF) reverse auction, winning several million dollars in RDOF awards to build out service within its area. While the carrier does utilize both wireless and wired network (and received Connect America Fund support to build out wireless specifically in some underserved areas), “All new builds for us are now fiber, unless it’s extremely remote,” says MidCo’s Chief Technology Innovation Officer Jon Pederson.

Midco considers potential areas of build-out and where to pursue funding opportunities, “We are only doing things that are adjacent to our existing fiber network. We’re not going to pick an island off in some state where we’re not. That’s been a strategy for us, and it helps us leverage the connectivity we already have.

“We like to use the term ‘edging out,’” he continues. “We edge out our network, and we don’t have to reinvent the wheel. And that’s important. It helps in two ways: To make sure the quality of service you’re providing is good and established, and then the other one is it makes it much more efficient. You’re not having to build super long-haul links or to lease circuits to extend



Inside Midco’s NOC

Image: Midco

service in that area.”

When it comes to balancing the business case for build-outs, technology choices and local geographic challenges, Pederson said, “I think the key is just a real honest strategic look.”

He points to an example for Midco: The company had a fiber ring in Minnesota that was working fine, but two smaller rings would be better for latency and resiliency. So when the company looked at its opportunities for support in mid-Minnesota, “there were certain unserved areas that were more attractive, because by connecting the dots, we were able to split that ring into two smaller,

higher-performance rings. It was very strategic: It accomplished providing service to unserved areas while benefitting our entire network. We try to take a very thoughtful look at all the opportunities and pick the ones that accomplish the greatest good.”

So how does Midco pick those opportunities? “We’ve actually formed a group just to analyze and reconnoiter all of those gifts, so we can figure out what’s best for us,” Pederson says. That is part of how Midco tries to ensure efficiency in its pursuit of programs and TCO, he says. Is a given program a federal one and if so, through which agency? If it’s a state program, which of

the five states Midco operates in? Is the funding a special program related to Covid-19, with specific bounds on use or timeframe in which to spend the money? It's a lot to keep track of, and the reason that Midco formed its specific team for that purpose. "If you're not up to that task, it could be a little confusing and you might miss opportunities," he says.

Pederson says that while Midco is "very interested" in 5G as it applies to the midband - specifically, to CBRS, which the company has already tested in a 4G context. He's much more measured about millimeter-wave-based 5G, saying, "We don't see that as a tool that we're going to use in the near future." But midband 5G use is on Midco's eventual technology roadmap, albeit "years into the future."

On the influx of broadband funding, Pederson says that "It feels a little bit like a free for all, and that's not what it is, and it's not how it should be approached. It should be seen as an enabler, all of these funds. And that means, maybe even more than ever, that you should be wise about it and build off what you always have and not scale beyond your means. I think that's important, and a certain



Image: Midco

conscientiousness needs to be involved in leveraging these funds to properly bring broadband to rural areas.

"There's more to providing broadband service than just running a fiber through the ground or putting up a tower," Pederson adds. "There's a lot of backend systems, so I think it's important that there's a certain established organization behind the effort," he says. "It's important to also map [pursuit of subsidies] to the capabilities of your business. I could see somebody overreaching, and you don't want to do that. ... There's dollars available. Do you have the team, do you have the resources to take advantage and to bring great service to rural America?"

Unintended consequences

All the funding and support for broadband sounds like a good thing: Connect all of America, finally close the digital divide, level the broadband playing field and make inroads on helping people to afford broadband. Right? Well ... it's probably going to be a lot more complicated.

For one, network operators and those who advocate for them are getting very nervous about where all the fiber for this broadband is going to come from. Finding-toilet-paper-in-early-2020-level nervous.

"When you throw a lot of money and say, 'Everybody build this,' all of a sudden you run into a supply and demand problem," said Nsight's Riordan. "We are already starting

to see that with fiber, truly.” Rioridan is thinking ahead on Nsight’s fiber needs, seeing lead-times and costs go up for fiber and engineering/design, and admits to wondering if the company (which relies on just-in-time inventory) should place a large fiber order and store it until it’s needed. “These aren’t projects that you would typically order in bulk ahead of time, because we don’t know what’s really going to happen. We don’t know what funds are going to be there, what community agreements are going to be in place, so ... we’re hesitant to do that. But I see in the next three, to four, to five months that we’re going to see major back-ups. That’s my prediction.”

The first wave of pandemic relief funds have to be used by the end of 2021 and the most recent package -- with that \$7 billion for broadband -- by the end of 2024. A lot of companies are going to be clamoring for a lot of fiber and other network equipment, all at the same time. Large carriers who have existing contracts for fiber will probably be protected from most impacts of a supply crunch, but what about the smaller operators who order on an as-needed basis?

“There’s going to be this sort of

deluge, and I worry about competing for resources and materials,” says Midco’s Pederson. He adds that right now, the concerns are more about future supply conditions than current ones. “I think it’s a little too soon for the reality of it. So this is speculation: Is it going to happen? And do you really want to take that chance? So we might be in a little bit of the hoarding-toilet-paper stage. But nobody wants to get caught flat-footed.”

“We’re seeing a minimum on the typical fiber products, of six months to a year and some as high as 18 months at the moment, and this is even before another \$100 billion get plowed into the marketplace,” says Claude Aiken of WISPA. Fiber providers like Corning acknowledge that lead times are extended, but say they are already working to get ahead of the coming fiber capacity needs: Corning plans to open a new fiber factory in Mszczonów, Poland next year. But fiber isn’t the only potential bottleneck -- CommScope reported in its most recent results that its Home Networks business, which focuses on CPE and which CommScope is in the process of spinning off, has a billion-dollar backlog.

Another concern bubbling just below the surface is the fact that the

FCC has already acknowledged that its broadband deployment maps are deeply flawed and begun the work to correct that, so that future fund disbursements can be more accurately targeted. But the broadband funding is coming largely without regard to the mapping effort.

The Competitive Carriers Association recently conducted analysis which found that 5.5% of RDOF award locations “likely include sites that have access to at least 25/3 Mbps fixed broadband,” and about 6.9% of RDOF locations “likely” have access to fixed or mobile



“We have promised and proposed and pushed for sound data, because it affects everyone.”

*Steve Berry, President and CEO,
Competitive Carriers Association*

broadband that meets the 25/3 threshold. By CCA's reckoning, that equates somewhere where \$115 million to more than a billion dollars going to areas that already have at least one option for either fixed or mobile broadband available that meets the RDOF minimum speeds.

CCA President and CEO Steve Berry says the analysis "proves that while the FCC said, 'we know that there's no broadband in these places,' they were wrong. It's a shame. We have promised and proposed and pushed for sound data, because it affects everyone." It's also easy to assume that most places considered "under" or "un" served are rural. But there are plenty of people living in what Midco's Pederson calls the "donut of discontent": Not far enough out to be truly rural, but not close enough in to be part of someone's existing service area; just beyond the reach of existing high-speed wireline networks, or stymied by line-of-sight issues with the local WISP, and maybe seeing single-Mbps speeds from legacy DSL that are worse than a further-out area that's served well by a regional operator or electrical coop. The FCC's new maps might help better identify and direct funding to such

areas -- but how much will already have been spent?

Then there are the thornier issues that money alone can't or won't solve. Berry says that in past programs, physical deployments in new areas have run into issues because there were no requirements on existing, larger network operators to interconnect with them once the network was complete. "We need to think about changing how we think about backhaul and whether or not we need to ensure that there's fair, equitable, economically sustainable connectivity requirements," he says. The timelines for permits, rights-of-way, environmental reviews and so on also may conflict with urgent funding that needs to be spent in a short time-frame. The complicated process of simply accessing the funding is only one piece of actually expanding into a new line of business or new geography, Carol Matthey says; such challenges could be regulatory or just the plain old operational grind of adding a new service to a new area: Ensuring the back-end systems are in place for you to onboard customers and send bills, hiring new employees for sales, installation or customer care, maybe

building or leasing a store.

Berry and Aiken praise fiber as an indispensable tool, but only one part of a broadband toolbox, and they express concern about it being so heavily favored in the current environment. In practical terms, Berry points out, providing fiber to a farmhouse doesn't mean there's connectivity in the fields and barns for precision agriculture - that requires wireless. Aiken makes the case that both in terms of future innovation and security, there are reasons to think hard about whether connecting the entire country with a predominant technology-type is the way to go.

"The Biden administration has changed the paradigm of what is doable in rural America in terms of fiber builds," Berry says. That's "phenomenal," because it means areas for which there wasn't a profitable business case, or where operators were waiting for USF funds to trickle in over years in order to build out, now have a promise of return on investment. But, he says, "It bothers me a little that the Biden administration wants to focus that change on new players that have never built a network before, whether it's states or counties or

localities. ... Very few localities are successfully doing that; they end up either getting a partner in, or they sell their properties off. I would like to say, ‘Why don’t you partner with everyone or anyone who’s in that area and give them an opportunity to show you their plans and how fast they can build out a network to provide broadband?’

As it happens, a consortium of companies have been exploring partnerships as one of the most compelling strategies for driving rural broadband deployment in an efficient and effective manner.

Achieving rural connectivity through partnership: C Spire-led research lays out new rural broadband business models

In a two-year research project, regional network operator C Spire led a group of companies that included Nokia, Microsoft, Facebook and others to explore the challenges of cost-effective rural broadband deployment - and what technologies and business model changes might help.

“The lack of broadband access in rural markets is typically due less to technical reasons than to commercial reasons,” C Spire’s Rural



A telecom tower in California.

Broadband Consortium concluded in a 23-page white paper that summarized their two years of work, which also included technology testing. “The typical large-city operator business model with economies of scale and high revenue opportunities with a quick payback period breaks down when used on smaller isolated or loosely scattered communities.”

C Spire had a unique, on-the-ground perspective as the primary coordinator for the research: It provides both fixed and wireless service, and its primary territory covers some of the most rural states in the country: Alabama, Mississippi

and Tennessee. Its insights as a rural network operator helped inform the research, but ultimately, the consortium concluded that multiple technologies—including satellite, which C Spire doesn’t offer—and third-party business and public-private partnerships could support faster, more efficient rural broadband deployment.

“Broadband access to rural households can be a unique engineering feat requiring multiple technology solutions. The design challenges to serving rural markets due to environmental variation also manifest in a provider’s business model,” the report said.

“Low population density, terrain and foliage, lack of backbone backhaul connectivity, lack of accessible infrastructure, and limited service provider resources are all items that a provider’s business model must account for. Thus, current broadband business models that depend on scale (especially a consistent, repeatable approach) are inadequate for many businesses to tackle rural connectivity. ... Deploying a network is usually the focus of an initial cost analysis. However, the ongoing operations and maintenance of running a network can also be challenging logistically and can likewise affect the business case. All parts of deploying and running a network affect scale and sustainability.”

But, the consortium added, “There is more to being an Internet Service Provider (ISP) than building a network. The options selected to run a network and provide services are also essential and critically impact the business case. While technology (building a network) is the highest upfront cost, other resources such as maintenance, sales, and marketing are on-going operational expenses.”

The most common business model

for broadband is that of an “operator-only ISP,” in which a single operator designs, builds, operates and maintains the network, and acquires and connects customers – and receives all the revenues from those customers.

The consortium offered up what it called a “third-party enablement model”, with different iterations in which two parties collaborate to provide service, allowing “shared costs, different levels of expertise, and more efficiencies in areas where owning the whole process is challenging.”

“While an ISP purchasing services or infrastructure access such as backhaul, could be viewed as a type of 3rd party enablement, the intent of this model is a deeper partnership where each party shares in both cost and revenue (risk and reward),” the report said. “The 3rd party is expected to be the customer-facing entity, while the operator is the enabling entity. Each party has a stake in how well the other performs, and each is invested in the outcome to the end-customer.”

The report said that there are three potential partner-types for operators: “Local stewards,” such

as a business owner, homeowner association or even individual consumers who can be creative and flexible in helping to establish broadband service; infrastructure providers such as local governments, utility companies or cooperatives who have assets that can aid in deployment; or partnering with an emerging or established ISP to share capabilities and toolsets in an arrangement in which could make increasing connectivity more cost-effective for both parties.

In addition, the consortium concluded, automation and optimization could be used to reduce costs in network design, build and deployment, as well as in customer interactions. “If this could be done as a shared backbone or platform for all rural builds, not just for a single market or operator, the per-market cost should become feasible,” the report offered.

“Sharing costs and expertise between large and small companies through third party enablement business models has the potential to ‘change the game’ and make rural broadband deployment faster and more economically feasible for all parties,” the consortium report concluded.

Key Takeaways:

Billions and billions of federal and state funding for broadband is underway and on the horizon, with much of it aimed at providing high levels of fixed and mobile services to rural America and bridge the digital divide. The influx of cash and political will, in the wake of the pandemic, has changed the paradigm of what people believe is possible to achieve

in rural networks. But navigating the programs to access the funds is a challenge in and of itself and the intense pressure on build-outs may have unintended consequences.

Networks, both of large and small operators, are navigating a series of simultaneous technology transitions. Operators will have to juggle all of those transitions to a great or lesser extent, while also

trying to substantially expand into challenging service areas.

Money doesn't solve every challenge that comes with operating a network that serves underserved or unserved areas: Operations, including workforce availability, network security, technical limitations on build-outs, customer care and marketing all have to be considered in TCO. ((...))

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