Forbes / Washington / #AllThingsMobile

The Dawn Of 5G: Will Wireless Kill the Broadband Star?

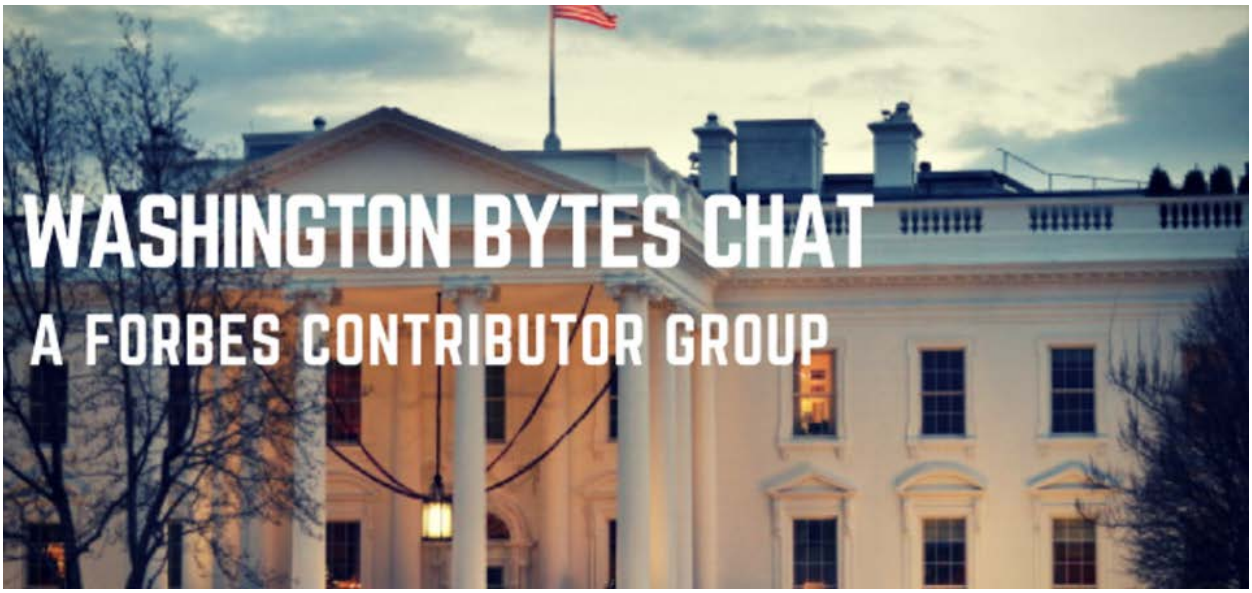
Washington Bytes, Contributor Hal Singer

We discuss the top technology policy issues in the Nation's Capital

Opinions expressed by Forbes Contributors are their own.

September 22, 2017

Published at https://www.forbes.com/sites/washingtonbytes/2017/09/22/the-dawn-of-5g-will-wireless-kill-the-broadband-star/#4e492196fd7f



Graphic by Daniel Kleinman, Forbes Staff

On this edition of the Bytes Chat, we explore the state of U.S. broadband competition and the likely impact of the fifth-generation ("5G") wireless technologies. Should cable companies be scared, and if so, how long will it take 5G to upset the competitive balance? Our special guest was Peter Rysavy, president of Rysavy Research, a consultancy on wireless technologies. Before founding Rysavy Research, Peter served as vice-president of engineering and technology at Traveling Software (later renamed LapLink), and as the executive director of the Wireless Technology Association. We were joined by network engineer Richard Bennett, co-inventor of Wi-Fi, international policy consultant, and founder of High Tech Forum; and Jodi Beggs, a consulting economist for Akamai

Technologies and founder of Economists Do It With Models. The chat was moderated by *Washington Bytes* editor Hal Singer. The transcript has been edited lightly for readability.

Hal Singer: Let's begin with the state of broadband competition. Seems like we can't describe competition until we measure it. In January 2015, the FCC redefined broadband upward to 25 Mbps. Richard, you've described the FCC's reasoning on the redefinition as being "thin." Why so harsh?

Richard Bennett: The FCC has failed to offer a substantial reason for raising the threshold. The agency's Measuring Broadband America reports have consistently shown that web pages don't load any faster at broadband speeds above 15 Mbps, and we don't need more than 15 for 4K Netflix streams. Many VDSL packages top out at 24 Mbps, so the UK defines ultra-broadband at 24. The 25 Mbps "Wheeler Standard" looks like cooking the books. There aren't any common apps that require 25 Mbps. It's nice to have fast file downloads, but we don't do much of that anymore.

Peter Rysavy: I don't think many mainstream apps today can take advantage of 25 Mbps. But in the future, virtual reality can consume massive bandwidth. When I analyze demand for wireless broadband, I look at both Internet and TV cord replacement. TV content delivered to households can drive values much higher.

Jodi Beggs: Do these findings—that 15 Mbps is sufficient—still hold when there are a bunch of devices hooked up to the same household router? Is there a benefit of 25 Mbps if a household has, say, 10 devices using the connection, even though no single app/device can use the full throughput?

Bennett: Multiple people surfing the web on the same broadband pipe don't have much effect on each other because there's a lot of idle time. Multiple Netflix streams can impair each other, however. But 15 Mbps is enough for two HD streams plus web. Internet-of-Things type devices don't consume a lot of bandwidth unless they're always-on cameras. Netflix is the main high bandwidth app of concern, and it uses about 4 Mbps per HD stream. Netflix Ultra HD requires 8 to 12 Mbps.

Rysavy: The biggest driver of bandwidth today is video, so the more devices consuming video at the same time, and the higher the resolution (HD vs. ultra HD for example), the greater the demands. Today, HD requires 4 or so Mbps. Sports with rapid motion can use up to 30 Mbps in UHD. But you'd probably need a 70-inch television to see the difference. Goes back to whether you're trying to also cut the cord to TV.

Beggs: So bandwidth requirements expand to fill the space sort of like processor requirements do with software?

Rysavy: Yes, people will consume any bandwidth you give them.

Bennett: The trend that I see is networks getting 35% faster year after year because Moore's Law. I only see about a 5% growth in application demand.

Singer: Shifting gears slightly, in terms of average download speeds, how much faster is the current generation of U.S. *wireline* connections than the current generation of U.S. *wireless* connections?

Bennett: The Speedtest Global Index says the average download speed for mobile is 23 Mbps in the US, and the average for wired is 73 Mbps. Akamai data is higher on wired and lower on mobile. But the ratio is roughly between 3:1 and 5:1.

Singer: Can a broadband user with a 10 Mbps wireless connection do the same things as a user with a 10 Mbps wireline connection? In other words, is there any measurable difference in quality between the two technologies holding download speeds equal?

Rysavy: For the most part, the two connections can do the same thing. A small cell connection will perform identically. Especially with 5G being designed for very low latency.

Beggs: Are there any performance differences between wireless and wireline in terms of latency (as opposed to throughput)?

Bennett: There are minor variations in latency on mobile networks, so wired tends to be more consistent…when it's working. 5G may actually have less latency than cable, right Peter? A DOCSIS cable modem has a lot of synchronization overhead—that is, when a DOCSIS cable modem starts talking, it takes the listener a while to tune into the message.

Rysavy: Not sure about latency for cable vs. 5G. Probably depends more on backend architecture, not the access technology.

Singer: You guys just can't wait to talk 5G!! We're not there in my outline!

Beggs: It's new and shiny!

Singer: Let's accept the FCC's 25 Mbps standard—warts and all—and focus only on wireline connections. According to FCC census block data analyzed by CMA Strategy, as of June 2016 there were over 46 million homes with only one provider of wireline broadband speeds greater than 25 Mbps (the "underserved" homes), and there were roughly 11 million homes have no access to 25 Mbps fixed-line service (the "unserved" homes). That's not a glowing report card, right?

Rysavy: Not if you use the 25 Mbps standard. But as discussed, most people don't need that today.

Bennett: Well, both the share of census blocks unserved (relative to all homes) and the share of census blocks underserved (relative to all homes) dropped from late 2015 to mid 2016. Compare Figure 4 of the April 2017 report to Figure 4 of the November 2016 report. And bear in mind that the areas the FCC calls "served at 10 Mbps" are really getting as much as 24 Mbps.

Singer: That's a good thing. And there appears to be even better news for broadband consumers on the horizon. Peter has a new report on the impact of the next generation of wireless technology or "5G" that might shake things up and make things better for folks living in underserved or unserved areas. Peter, can you explain to our readers what 5G is, and how it materially differs from the current, fourth-generation ("4G") wireless technology?

Rysavy: The most important features of 5G are the ability to use a wide range of spectrum, radio channels of many different sizes, and the ability to address a wide range of use cases. For example, 5G will work in any band from 600 MHz to 100 GHz.

Beggs: How does this help from the average household's perspective?

Rysavy: 5G will have the capability to compete directly against wireline technologies such as DSL and cable. Also fiber in some cases. This will result in more broadband options for consumers.

Bennett: I expect the cable guys will build 5G networks, but that won't increase competition. Households care about speeds, prices, and reliability.

Beggs: Why would a household care about the frequency range?

Rysavy: They don't care about frequencies. But I had to wait many months for Charter to bring coax under the street to my home. With 5G, the connection could have been installed much more easily.

Bennett: The discussion about "broadband" tends to be too focused on wired networks, but we've moved on. Wireless is now the primary network and wired is the accessory.

Beggs: Right. It seems like one of the main advantages of wireless in general is that it greatly lowers the fixed cost of onboarding a customer who doesn't have existing broadband infrastructure. Why is that?

Bennett: A great deal of the cost of building a network is the last 1,000 feet. FiOS costs Verizon about $700 to $1,000 per home, but small cells lowers that cost to $100 to $200 per home.

Rysavy: The cable guys are looking at 5G. Charter is doing some trials. But they will be at a competitive disadvantage compared to a cellular operator doing dense 5G deployments.

Beggs: Why are cable guys at a competitive disadvantage?

Rysavy: Because a cellular operator with a dense 5G network can provide both fixed and mobile broadband. A cable operator will only have a fixed network. To support handsets, the 5G network will tightly integrate with 4G for coverage. Cable operators don't have that macro 4G network to fall back on.

Bennett: Can't cable operators build small cells? Nobody has them now.

Rysavy: Yes, cable operators can and will build small cells. But, as mentioned, they can't provide the continuous coverage, especially for mobile devices.

Singer: Peter, when do you envision 5G being routinely available to large swaths of the country? I need an exact month and day. Kidding. How about a year?

Bennett: When does the buildout start, when does it hit 50%, when does it hit 90%?

Beggs: [opens calendar, gets out pen]

Rysavy: As for 5G becoming available, depends on strategy. T-Mobile is deploying 5G in 600 MHz, and will be able to turn it on quickly across the country. Verizon is deploying small cells, but that will be a much longer undertaking, maybe a decade. 5G buildout will begin 2019 or so. Keep in mind though, that massive capacity gains rely on small cells and using mmWave.

Beggs: So does that mean that T-Mobile would be offering me a replacement for home broadband or will it still be only for mobile?

Rysavy: T-Mobile plans on running 5G in 600 MHz. That network won't be much different than T-Mobile's LTE offering as far as capacity and speeds. So T-Mobile's network will not be a home broadband solution. At 600 MHz, operators have tens of MHz of spectrum. At 28 GHz and higher, they have hundreds of MHz. Capacity is proportional.

Beggs: So pretty much more of the same, just faster.

Bennett: Mobile broadband is hampered by data caps today. Those have to increase for people to cut the cord on cable modem. Interestingly, T-Mobile raised their unlimited data caps yesterday from 32GB to 50 GB.

Rysavy: Agreed about the caps. Throttling is in place today so users don't experience congestion. Throttling addresses real capacity limitations. The result is that today, 4G LTE provides a much more consistent user experience than say, Wi-Fi at airports. But if the network has much greater capacity, operators can offer much larger plans. 5G in small cells with mmWave increases capacity by 100 times or more. So caps for 5G will be consistent with other fixed broadband, such as 1 TB per month.

Singer: Jodi, what date did you mark in your calendar? Not sure I've got an answer.

Bennett: It's probably a ten-year project overall.

Singer: In the long run, we are all dead.

Beggs: I'm going to be so mad at you guys if 2019 rolls around and I don't have 5G on my phone.

Bennett: 5G is a marketing term so you'll have it on the 2019 phones. Even if there's no network to connect to right away.

Rysavy: You should probably adjust to early 2020s for any decent coverage and availability in handsets.

Singer: Peter, what percentage of U.S. homes do you expect to switch to a pure wireless home Internet solution within (say) the next five years? Or the next ten years? And if it's large, wouldn't that represent a massive redistribution of spending from cable operators like Comcast and Charter and towards wireless operators like Verizon and AT&T?

Bennett: Pew says that's already happening; peak wired broadband was like 3 years ago.

Beggs: Hal, your question assumes that cable operators don't get into wireless, either organically or via acquisition.

Rysavy: Within 5 years, 5G could support 50 million homes or more. With respect to redistributing spending, yes, if cellular operators can roll out the hundreds of thousands of small cells, the competitive landscape will shift in a major way.

Singer: But "could support" is different than actual penetration right? I'm trying to figure out how much wireless substitution we should expect.

Rysavy: I believe that eventually consumers will pay for just one broadband connection, fixed and mobile. When I say 50M or more homes, I mean wireless substitution. I think you can draw a parallel with local telephone service and long distance. The long distance business evaporated. Similarly, today's fixed and mobile broadband services will collapse into one. The cellular operators today are better positioned to take that market.

Beggs: But the cable operators are probably going to try to fight them.

Singer: So is it fair to say cable operators will be the "losers" from 5G and the telcos will be the "winners"? Or will cable also get into the act?

Rysavy: Cable operators will defend their business, but they don't have the massive mobile infrastructure that the cellular operators have. Cable operators face a serious threat from 5G. A dense 5G network will leapfrog over current cable coaxial networks in capability. So customers could see greater speeds and bigger buckets.

Bennett: Cable is learning about the wireless edge from their Wi-Fi experiments. With their massive backhaul, all they need is an edge. And don't things get interesting if Spectrum (the former Charter and Time Warner Cable) buys T-Mobile?

Beggs: I worry about that merger because that likely would reduce competition and/or give Spectrum an incentive to hold back on what T-Mobile offers for fear of cannibalization.

Singer: Sticking with the competition theme, does the fact that 5G wireless will be provided by fiber to the home (FTTH) providers imply that those operators will be reluctant to deploy both technologies (FTTH and 5G) for fear of cannibalization?

Bennett: Once we have 5G, we don't need FTTH. Look at how people use FiOS: the primary connection is Wi-Fi. I suspect we'll have 5 to 8 5G options in cities and suburbs.

Beggs: But more generally, it's important to note that the cannibalization provides an incentive for cable companies to block innovation.

Rysavy: Separate operators provides no benefits. Instead, as operators densify their fiber networks, they'll want multiple access technologies. In some cases, FTTH makes the most sense, such as for companies with big servers on the Internet, or needing huge bandwidth to partners or other locations. But in other cases, radio works better. A home user may never need fiber, but many businesses will.

Beggs: Separate operators provides no technological benefits but may provide competitive ones.

Singer: Econs teaching engineers economics! Peter, in your paper you forecast the number of small cells. Why is the number of small cells important for understanding 5G?

Rysavy: The number of cells is central to capacity. First, mmWave only works over shorter distances, so cells are inherently small. Second, to get the capacity gains, you only want a small number of users in each cell.

Bennett: See Hal, bigger is not always better.

Singer: Picking on the short guy? Let me also ask another from the naysayer department: At some point, Verizon stopped pushing FiOS out in its territory. Why will things be different for 5G? Are the economics for 5G that much better than the economics of FTTH?

Bennett: The FiOS deployment stalled when Verizon ran into markets where the uptake was too low. Consumers tend to go with what's good enough, not with what's best.

Rysavy: The economics are similar in needing to push fiber closer to the edge. 5G provides an advantage for the last 100 to 250 meters. FiOS and 5G are complementary.

Singer: So does that mean that Verizon will push 5G deployment to 100% (or something close) of its wireline footprint? And if so, will I get to keep my FiOS or will that service be discontinued?

Rysavy: Verizon's fiber acquisitions are as significant as their 5G plans. Once you have fiber to a building, there's no reason to ever stop using it. So you should be able to keep your FiOS.

Bennett: Verizon will have some hard decisions to make about overbuilding FiOS with 5G. FiOS areas will be cheap for small cells because you already have backhaul in place. Could be they'll do thin 5G deployments and play with pricing. They don't want to cannibalize existing accounts.

Rysavy: The same core fiber network should be able to support both FiOS and 5G, so if one building has FiOS, I don't see any reason why the next one can't be served by 5G.

Beggs: It's important to make explicit that the main benefits of 5G are for those households that are currently unserved or underserved. For everyone else it's incremental change at most.

Bennett: Actually, the main benefits of 5G will fall to underserved homes. Unserved homes will get non-mobile 4G.

Singer: Say it isn't so! Peter, is 5G not a solution to the unserved problem in rural areas?

Rysavy: Richard is correct. Regarding rural areas, small cells using mmWave with 100 to 250 meter range don't make sense for rural.

Bennett: Where the only network is DSL at less than 15 Mbps, a 100 Mbps 4G non-mobile network makes a lot of sense. Rise Broadband is building fixed wireless in rural areas with some success. They acquired 120 WISPs.

Rysavy: And the 3.5 GHz is coming online and that will provide greater range. Ultimately, 5G will play a role in rural, but it may use different architectures than the initial wave of 5G deployments. 4G or 5G in lower frequencies is a good rural solution. Also, 5G will improve over time. More antenna elements will allow focusing of radio beams, extending range.

Singer: Peter is not the only guest engineer with a new paper on broadband. Richard has a fascinating new pieceon measuring Internet performance. One cool factoid was the finding that of four major newspaper websites studied, three loaded faster since 2010, but the *New York Times*needed more time to load. In particular, above-the-fold text that appeared in four seconds in 2010 now takes six seconds. Richard, aside from the being the enemy of the people, what's wrong with the *New York Times*?

Bennett: The web is generally stagnant in terms of speed. The *New York Times* has too many ads and a slow content delivery network.

Singer: While 5G may speed up the overall load, do you anticipate publishers adding page weight that negates any improvement to the end user experience?

Rysavy: I think a lot of web pages are already sagging under the weight of all their ads. Networks are becoming so fast that in many cases, the content servers can't send out the content fast enough.

Bennett: Pages aren't growing that much larger, but they can't load until the ad auctions are complete. So the performance of the web has less and less to do with network speeds.

Singer: Richard, your paper explains how several factors outside of network speed can affect webpage load time, including Web server performance, browser performance, webpage design, and human factors. Given these myriad factors, how is it possible for users to detect the proximate cause for slow page loads and take action to resolve them? Or is it just easier to blame their ISP?

Bennett: The FCC's Measuring Broadband America datashow pages don't load faster on 100 Mbps pipes than on 15 Mbps one tells us a lot. They have a scatter chart for web page load time that shows the threshold is 12 to 15 Mbps. The text will say pages don't load faster above X, where the value of X is the current broadband definition. But the charts

don’t lie. People have been trained by certain (unnamed) media outlets to blame their ISP, but the pokey web is on the site owners and page designers.

Beggs: As one with a web site, I can confirm that this is generally the case. Visitors probably yell at Comcast because I didn't splurge for the better AWS service, for example.

Singer: Let's turn to some policy implications for the last stretch. Because 5G will likely be first deployed in dense areas, such as major cities, do you think there should be incentives for operators to rapidly deploy 5G in less dense areas? For example, do you envision mayors and city councils offering to help defray the cost of new equipment/sites or to change permit processes in order to woo faster than planned deployment of 5G to their areas, similar to the Google Fiber gambit?

Beggs: I guess I don't understand why providers don't have the incentives to do this on their own. As a manager, wouldn't you rather go where there is more upgrade benefit and less competition? I know it's not that simple, but I find it perplexing.

Bennett: Some municipalities are doing the opposite of a subsidy, by insisting on high fees for small cells, because of their pension obligations. These cities will be slow to upgrade.

Rysavy: More important than subsidies is to simplify the ability for operators to deploy new infrastructure with consistent policies across regions. So maybe incentives are not needed, but removing the barriers is.

Bennett: I think the operators do want to go where the money is. State legislators are hearing bills to cap the fees municipalities can extract for small cells. If some states impose monopoly fees on attachments to light poles and traffic lights, they can demand them. But they’re gonna be bypassed. Some states are setting fee caps across the whole state, but cities complain the caps are too low.

Beggs: I think it'd be helpful for people to know that their governments are potentially limiting their Internet options for the sake of revenue.

Singer: Policymakers from rural areas (no names) seem fixated on addressing the unserved homes. But aren’t underserved homes also deserving of some attention from policymakers? Would you guys support an end-user subsidy to stimulate demand in those areas, or from the supplier’s side, a tax credit to subsidize deployment by a second or third operator?

Rysavy: I'm not sufficiently trained in economics to answer that question.

Singer: That’s never stopped a guest from opining about policy!

Rysavy: Maybe it stops engineers like me.

Beggs: I would want to understand the degree to which the underserved households are affected by monopoly power before making a statement on this. For example, having somewhat higher than competitive pricing is far less of a problem than no access at all. Subsidies should only be necessary if the fixed setup costs, even if lower, still outweigh potential profit from new customers. I think that I would want to see how it plays out on its own first. The change in cost structure might solve the problem in itself.

Rysavy: Even the economist is hesitating.

Bennett: We need a combination of new tech, subsidies, and builder-friendly permitting.

Rysavy: The great thing about some of the forthcoming technology is that it will be increasingly easier for even small entities, like smaller WISPs, to deploy broadband in rural areas. Fiber densification and small cell deployments are the "railways" of this century. Regions that encourage deployment will benefit.

Singer: Ok guys, we'll have to end it there. Thanks so much for joining!