

From the Magazine: Can Wireless Deliver the Internet to Everybody?

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Facebook founder and CEO Mark Zuckerberg made quite a splash in late August when he announced the launch of a remarkably ambitious project, called Internet.org, aimed at bringing high-speed Internet access to the two thirds of the world's population that are not yet connected. As described in interviews, press releases and on a slick (but largely information-free) website, the plan to serve those roughly 5 billion people involves massive deployments of broadband wireless networks, sharply reduced prices for user terminal devices, and major advancements in spectrum and data usage efficiency. It is without question the biggest wireless project ever considered by a serious industry player.

Right now LTE networks worldwide serve perhaps 125 million users, the vast majority in economically developed countries where the required investments in infrastructure and user equipment, and in network engineering, can be supported. Considering that Internet.org plans service for roughly 40 times that number, with most networks to be deployed in poor countries that don't possess much in the way of either financial or engineering resources, it's easy to be skeptical. In terms of both technology and economics, can such a project possibly work?

Apparently, Zuckerberg and Facebook aren't the only ones who think that it can. Internet.org has attracted (or perhaps convinced) a number of the industry's heaviest hitters to join, including Qualcomm, Samsung, Ericsson, and Nokia. (It's not clear as of this writing whether Microsoft's acquisition of the Nokia handset business will pull them into the mix.) That's a lot of firepower, but it remains to be seen how much money and developmental resources each of these companies actually brings to bear on the Internet.org project. It's not exactly like they have nothing else to keep them occupied for the next few years.

Regardless of the daunting challenges, or perhaps in part because of them, the Internet.org plan is certainly compelling and intriguing, and it's not entirely without precedent. In the early days of cellular few industry insiders, myself included, predicted that in 20 or 30 years basic wireless voice service would be widely available, and even affordable, in much of the "third world." But a few visionaries like Grameen Bank founder and microfinance guru Muhammad Yunus realized that wireless provided a means for developing countries, like Yunis's native Bangladesh, to overcome a lack of embedded infrastructure and bring their telephone services

immediately to something resembling modern standards. At the same time, Yunis and others recognized that wireless opened a vast field of opportunities for micro-capitalized businesses that could be launched in even the poorest demographics. Many experts believe that deployment of cellular networks in developing countries is one of the major reasons why the economic growth rate in those countries has far outstripped that of industrialized nations over the past 15 years.

It's been argued that delivering basic voice service to the world's poor provided the lion's share of communications-driven economic and social impact, and that adding high speed Internet service, at a proportionately much greater cost, will net more modest gains. A subsistence farmer in a remote village can negotiate the sale of his surplus crops and livestock over the phone about as well as he could do it online, and probably a lot better if he is illiterate. Are Facebook and Twitter really better than voice for remote social interaction? But I believe that this is narrow and short-sighted thinking. The real potential value of high speed Internet in underdeveloped parts of the world lies in its promise of dealing with the problems that perpetuate poverty, such as lack of education and proper health care. I also believe that for the Internet.org project to be successful, those long-term, socially important applications must be embraced as the model for development.

In fact, application-oriented design will probably be essential for practical delivery of Internet services to third world populations. For one thing, there is the matter of available spectrum. Even if every bit of practical spectrum is used for wireless broadband it won't be nearly enough to provide unlimited services on the order used by, for example, American consumers. The reason why we can enjoy streaming video and other data hog applications, which by some estimates comprise over 90 percent of all Internet traffic, is that they are mostly accessed by wire or fiber-borne services. If all of a sudden Americans decided to ditch their wired Internet connections like they have their landline phones and rely instead exclusively on LTE, existing networks would be hopelessly overloaded. Doubling or even tripling the amount of spectrum available for LTE networks wouldn't come close to making up the capacity deficit.

It's clear that Internet.org recognizes spectrum limitation as a major technology hurdle, but the solutions they are targeting, at least in their public disclosures, are probably not going to be sufficient. Enhancements in data compression will make video in particular a bit less data hoggish, but probably not by that much. Major efforts at improving spectrum modulation and coding efficiency could produce similarly modest enhancements, which are in any case limited by Shannon's Law. In my opinion, the technical area that should get the greatest focus is network self-optimization, particularly interference management. As I have previously argued

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(see “LTE Network Self-Optimization: Looking to the Past & Future” Wireless Week May 3013), automated real-time frequency optimization has the potential of vastly increasing LTE network capacity. And automated network design and self-configuration are probably going to be essential for practical large scale deployments in third world countries where trained network engineering resources are pretty scarce.

Barring a miracle, however, it’s unlikely that any efforts at improving spectrum utilization will be sufficient to allow LTE networks to deliver western-style unlimited Internet services to general populations. This is where application-oriented design becomes critical. Instead of entertainment – primarily on-demand streaming video – third world wireless broadband networks should probably be aimed at more socially critical applications like education. An hour of standard definition video will consume about half a gigabyte. The same amount of data could deliver the content of several hundred textbooks. Video needn’t be eliminated altogether, but it might be limited mainly to Internet broadcast services shared by many users. That model could easily be adapted to “distance learning” tools such as the renowned Kahn Academy series.

Compared to spectrum limitations, other seemingly immense challenges such as the cost of infrastructure and subscriber equipment may prove to be less daunting. In many cases the economics of sheer scale will provide a path to practicality. Application oriented design will play a role here, too. For example, most third world users will probably find that LTE access for their hand-crank powered portable computers will be more useful than a much more expensive smartphone.

Given sufficient development resources (both money and brainpower) aimed at solving the right problems, I am cautiously optimistic that Mark Zuckerberg’s vision of Internet for everybody could become a reality. And it could quite literally change the world.

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