The Mural Project

Overview:

Mural's goal is to develop and execute a strategy for bringing broadband to under-connected people on a grand scale. Our method is to work through K-12 schools, libraries and community colleges in rural areas. As these institutions increase and improve their connectivity (42% of schools upgraded their broadband in the last year, for example) the gap widens between the services they can offer and what their constituency can consume at home, thus increasing the need for Mural. For education this is gap particularly acute, with strong e-learning initiatives pushing educational content online, and increasingly relying on digital-based tools, even though large swaths of students still lack sufficient connectivity to access those same tools from home. This problem is often referred to as the "Homework Gap."

Working through K-12 schools, libraries, and community colleges enables Mural to solve three difficult problems traditionally associated with connecting large rural populations:

- It solves the backhaul problem, as these institutions are connecting online and improving their connectivity much faster than their constituency is. In addition, the school's bandwidth will typically be used only during the non-instructional hours of the day, when students are completing their homework and the school itself doesn't need access.
- These institutions have community trust and broad reach, and thus can serve to address large portions of the local population in need of connectivity. In most rural and small communities, the local school and library are often the community's anchor institutions. This role will be valuable for raising awareness of the Mural project, for device dissemination, and for coordinating community training.
- Focusing on educational initiatives allows us access to the EBS spectrum.

Our technical approach is to use these public institutions for backhaul, training, and device dissemination. For access, we use LTE to either MiFis or CPEs at the residences, and we use microwave to bridge access to the backhaul.

We are taking an active approach to driving down the traditional costs of WISPs, by focusing heavily on cost sensitive areas and minimizing operating expenses. First, we've chosen to use LTE to reduce set up and repair costs. LTE also reduces the line of sight dependency that is disrupted by foliage, and it has better power density for improved range. Secondly, we're relying on an SDN LTE stack that has simplified bring-up and management compared with traditional stacks.

TAM Analysis (United States Only):

Our initial goal is to target the **26 million** under-connected people in the United States.[1] However, we plan eventually to use the same model to include all the Americas in our scope.

12 million K-12 students reside in rural areas, of which 42% do not have broadband.[2] Assuming a 3-person household per student, that results in a **15 million**-person reach from K-12 alone.

There are currently nearly 600 rural community colleges in the United States. Surveys from 2008 show that these serviced 3,477,449 students.[3] However, given that community colleges are the

fastest growing education sector in rural areas, this number is certainly far larger by now. Even with these outdated numbers, extending the reach of community colleges into the household nets **4-5 million** additional users, depending on assumed household size.

80% of all libraries are rural libraries, serving a population of 37 million, of which **15.5 million** are under-connected users.[4] Further, nearly all US libraries (98%) already offer free public WiFi. While it's hard to establish precise numbers on the total reach of all rural libraries, a sampling of studies suggests that 65% of Americans visit a library at least once a year.[5]

Obviously, there is heavy overlap between these three groups (under-connected K-12 households, community college households, and library visitors). However, by targeting all three groups combined, we are confident that we can develop enough reach to access the vast majority of under-connected rural Americans. In addition, we think our initial efforts will provide a proving ground for expanding our efforts more broadly and across boarders.

Broader TAM Analysis:

While our analysis outside of the United States is cursory thus far, our initial explorations are very promising. First, the connectivity of schools to the Internet is a global phenomenon whose penetration dramatically outpaces that of residential connectivity. In Brazil, for example, 95% of the schools have broadband access,[6] servicing **50 million** K-12 students.[7] And this is in a country where 35% of the population (70 million people) lacks access to the Internet.

Chile is another example of the strong global push towards connectivity in schools. In 1992, the Ministry of Education started the *Plan Enlaces* to ensure Internet access to public schools (where most Chilean children are educated).[8] By 2010, the Ministry had already spent $200M towards this goal. The Chilean K-12 system has a reach of **4.75 million** students, in a country where only half of the population uses the Internet at present.[9]

References

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