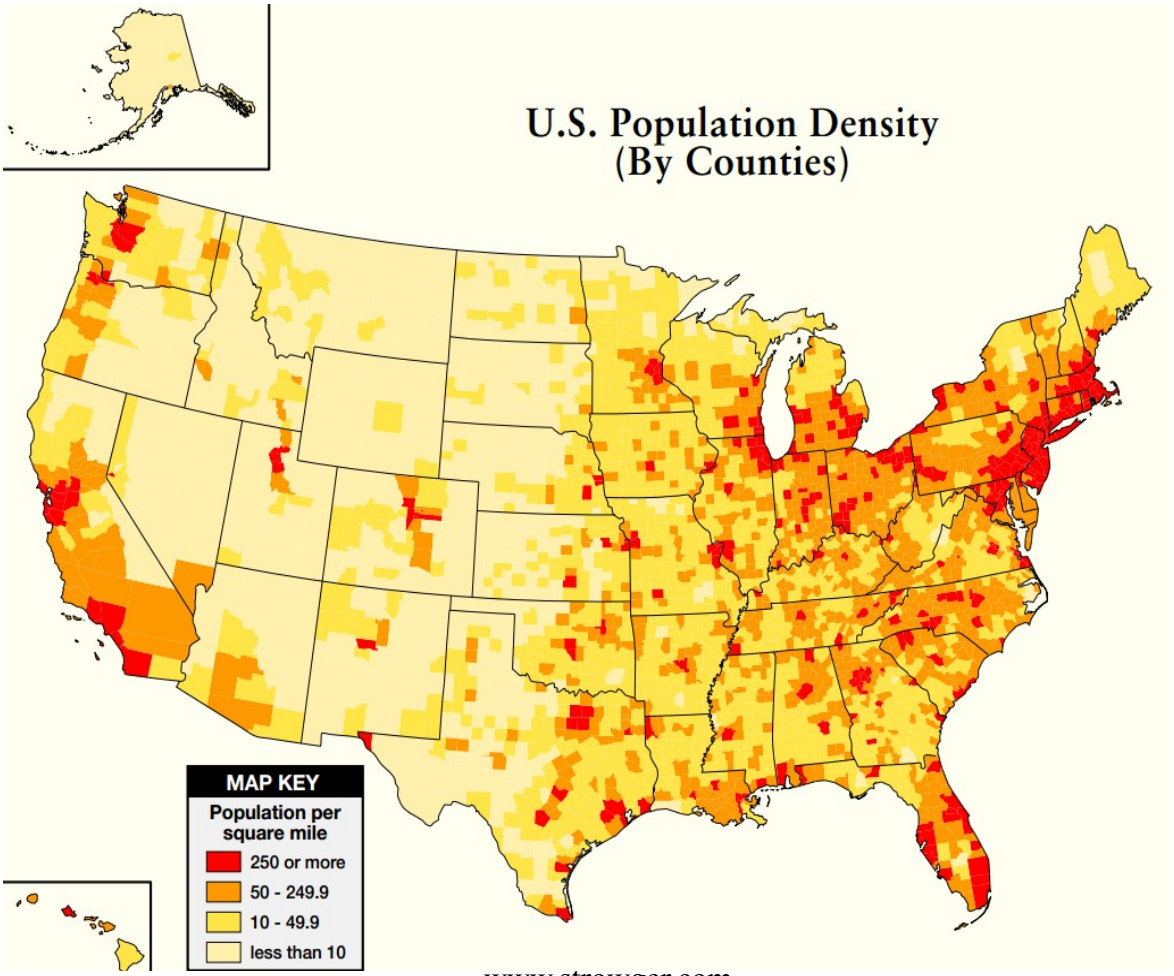
A Rural Telco Strategy for the Connect America Fund

Connect America Fund (CAF) is the FCC program to transition the purpose of the Universal Service Fund (USF) to subsidize broadband instead of POTS in high cost areas. It's objective is to make broadband available throughout the US by the end of the decade. Phase I starts early 2012 and defines BROADBAND as 4 Mbits downstream 1 Mbit upstream (the 4/1 problem). In five years, this will be upgraded to 6 Mbits downstream, 1.5 Mbit upstream.

The Connect America Fund represents a major opportunity and competitive threat for rural telephone companies. If the rural operators cannot claim 4/1 broadband availability across the entire footprint quickly, they will lose USF subsidies and be exposed to competitive threats subsidized by the federal government. If they can credibly claim 4/1, they can roll their USF subsidy into the new Connect America Fund and preserve the franchise.

How can rural telcos extend these services to rural subscribers in a timely yet cost effective manner? Existing DSL profiles are typically 3M downstream and 768 kilobits upstream at best for rural subscribers, but often much lower. Often the longest reach subscribers are simply best effort where anything above 100kbits is considered satisfactory. Meeting this new requirement throughout the footprint will present significant challenges. How then can the rural telco re-engineer their plant to meet this objective?



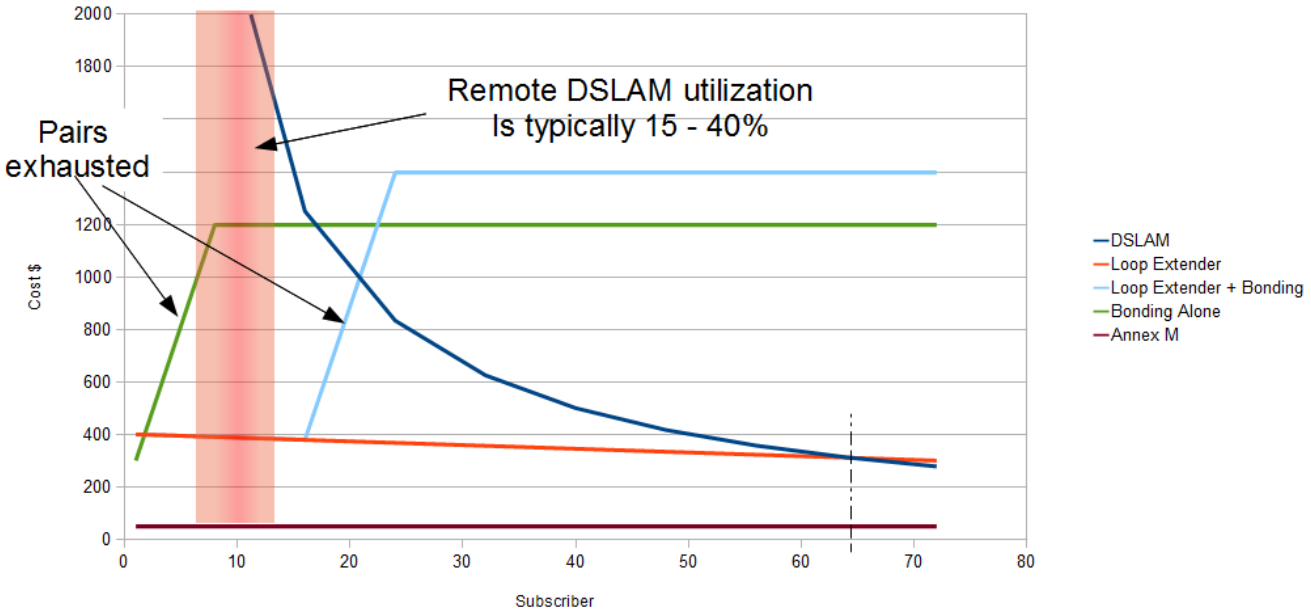
Strowger

The 4/1 Problem

Given enough time and money, fiber to the home would be the strategy. The FCC also has a bigger objective in the National Broadband Plan that clearly outlines an objective to reach 88% of the homes in America with 100 Mbits downstream and 50 Mbits upstream by 2020. Trouble is you don't have infinite time and money and fiber to the home for the last 12% of your subscribers isn't a realistic possibility any time soon.

VDSL2 can't deliver 100 Mbit beyond 1000 ft, therefore the number of DSLAMs needed to meet the 100 Mbit requirement will be about 25 per square mile. VDSL2 doesn't appear to be a reasonable solution for these fastest speeds in areas where you have less than 250 subscribers per square mile.

In remote areas, pushing DSLAMs deeper into the countryside will result in much lower utilization rates per DSLAM. In the chart below, you can see that low utilization rates on remote DSLAMs often drive the cost per subscriber above $2000. Increasing the number of DSLAMS to meet the CAF objectives is probably not practical. To meet the lower 4/1 CAF speed target for the last 12% of your subscribers, more remote DSLAM installations just aren't cost effective.



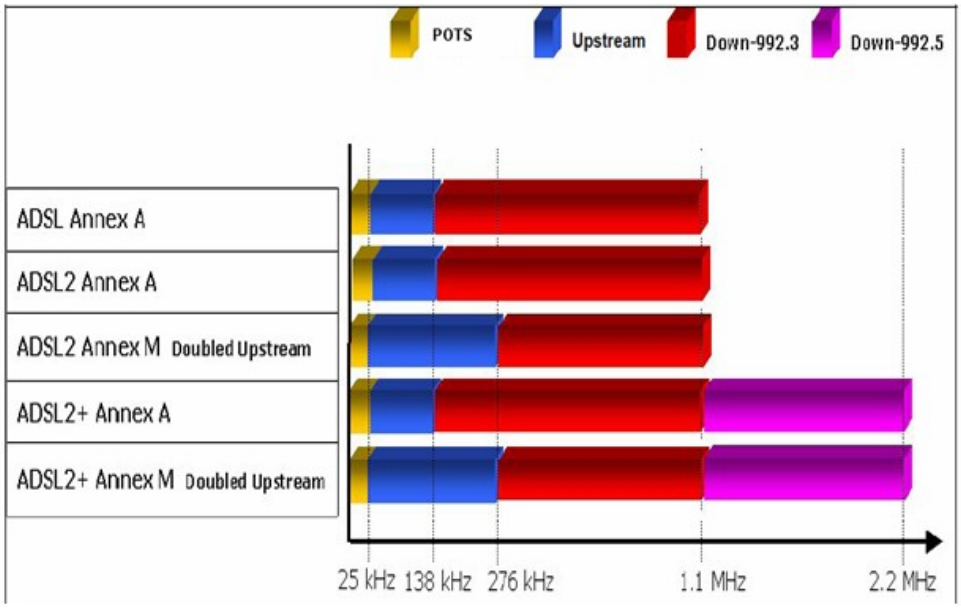
INSTALLED Cost Per Subscriber Served

Even if your existing customers can get 4 Mbit downstream, they will be left out of your broadband statistics if they can't get the 1 Mbit upstream rate. ADSL2+ Annex A maximum upstream rate is 1.3 Mbit, theoretically. Although 900k+ rates are reliably attainable over long loops under normal line conditions, 1 Mbit upstream is often NOT reliably attainable very far from the Central Office. Getting 1 Mbit upstream, let alone 1.5 Mbit upstream will be more difficult than the downstream requirement and will require rethinking the problem.

Solving the 4/1 problem is a rather urgent need since it will be the basis for USF subsidies

instead of POTS lines beginning in 2012. Also, it appears that rate of return carriers will be required to offer this 4/1 broadband service wherever reasonable. Fortunately there are several technologies that can be deployed, in combination, to make the transition easier.

What is the difference between ANNEX A, ANNEX M, VDSL?



Before ADSL2+, Annex M downstream was limited to 3 Mbits, but this is no longer the case. The main difference between ADSL2+ Annex M and ADSL2+ Annex A is that the upstream/downstream frequency split has been shifted from 138 kHz up to 276 kHz, allowing upstream bandwidth to be doubled, with a slight decrease in download bandwidth. A simple way to think of this is that the distance you can deliver your existing ADSL profiles will be decreased by 1 – 2 kft if you switch to Annex M.

VDSL2 can be configured to use either 138kHz or 276kHz frequency bands for U0 upstream and should behave like Annex A or M respectively. VDSL2's primary objective was to provide 30Mbits less than a mile from the DSLAM. Although it can be utilized on longer loops, the performance is generally worse than ADSL2+ on longer loops. VDSL2 will almost never be a simple configuration change, but will usually require a forklift upgrade to your DSLAM. Switching to VDSL2 is not an especially useful way to deliver a Connect America solution.

Solutions

Some plan to address the 4/1 problem with pair bonding. This will work for a handful of customers until, eventually this strategy will lead to cable exhaustion. After you exhaust the available pairs, the cost to add the next subscriber is far too high to be practical. Furthermore, pair bonding does little to address the distance problem and will be limited to 4/1 subscribers at 19kft on 24AWG. For most telcos, this will still leave a lot of potential subscribers unserved.

For many, switching from ADSL2+ Annex A to Annex M will be a very timely and cost effective solution. Annex M will deliver up to 3 Mbits upstream while still preserving most of the downstream potential in ADSL2+. For many DSLAMS and modems this is just a configuration change, or maybe a software upgrade; in either case the cost is minimal. But it is also limited to 15kft for 4/1 service, so it will also leave many unserved.

Fortunately, you can address these long reach customers very effectively with ADSL2+ Loop Extenders. Annex A ADSL Loop Extenders have been used extensively by rural telcos for seven years in the USA and 10 years elsewhere. This is a proven technology with a long track record of stability and cost effective use. New Line Powered Annex M Loop Extenders are now available that are a minor change from the Annex A versions. Annex M loop extenders are simple to install and cost less than $300-$400 per subscriber including loaded labor rates for installation time. For more information on ADSL Loop Extenders, visit http://www.strowger.com/solutions/adsl-loop-extender.html

The options available to solve the 4/1 problem are:

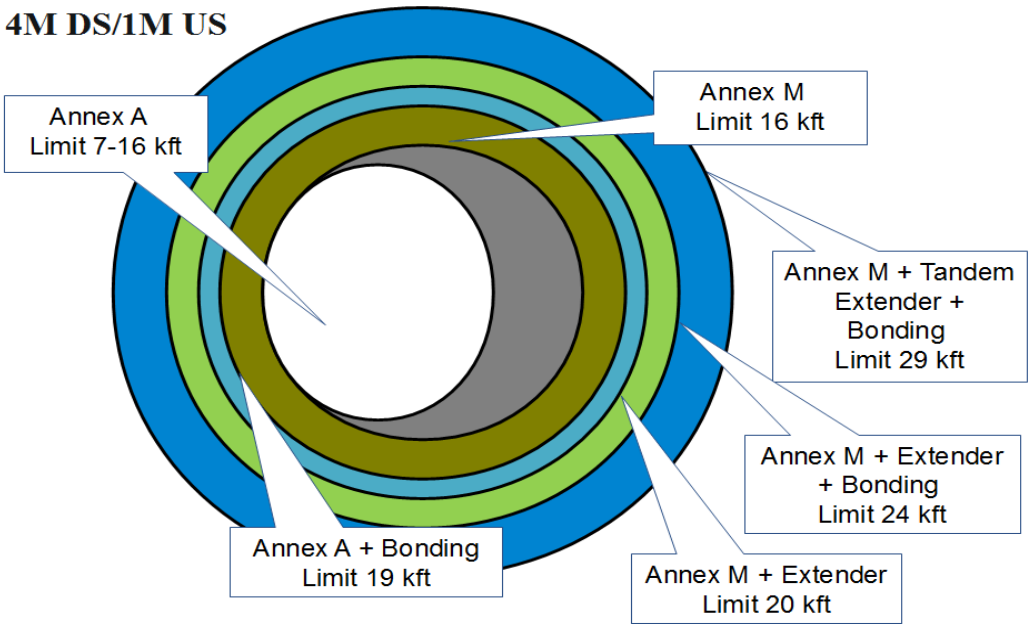
- More DSLAMs (a lot more) – Limit 7-16 kft depending on plant condition. This is prohibitively expensive, long lead time, may not reach 1 Mbit goal unless the cable plant has few interfering services and is otherwise in excellent condition.

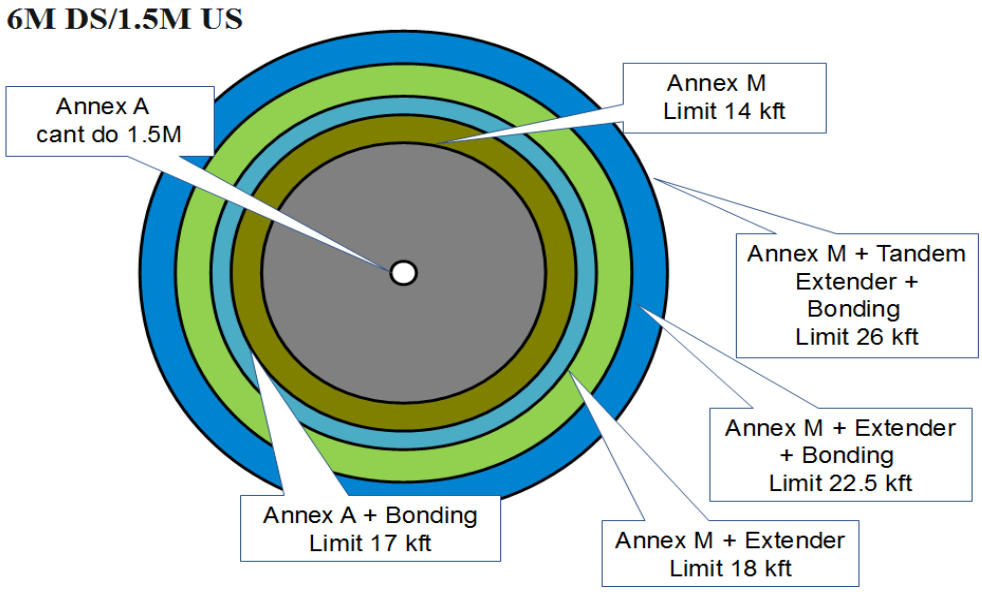
- Annex A + Bonding - Limit 19kft*, leaves some subscribers out of reach, exhausts available pairs. Needed on 100% of all pairs in 2017 to do 1.5M upstream.

- Annex M - Limit 16 kft*, lowest cost, leaves some existing subscribers out of reach.

- Annex M + M series ADSL Loop Extender - Limit 20kft*, $300 per subscriber beyond16kft

- Annex M + ADSL Loop Extender + Bonding - Limit 24kft*, A reasonable cost for the longest loops. Add Tandem extenders to get yet another mile.





Lowest cost Strategy

The least cost strategy is to switch to Annex M, then use extenders and finally pair bonding to provide service to the most remote subscribers. The essence of this strategy is:

- Switch to Annex M – very quick, low cost solution.
- Loop extender from 16kft to 21kft*, least cost way to add another mile.
- Loop extender plus bonding from 21kft to 24kft*, not as likely to cause pair exhaustion.
- Tandem extenders plus bonding for that push to 29kft* for the last few customers.

Annex M Advantages

Switching to ADSL Annex M should be a very simple configuration change in most cases costing nothing to implement. Annex M is able to deliver 4/1 service at a low cost and 6/1.5 far more cost effectively than Annex A. So long as it is implemented on an entire binder group at once, very little advance planning is required. It requires no delay for construction and allows you to spend precious capital dollars solving other problems.

Footnotes

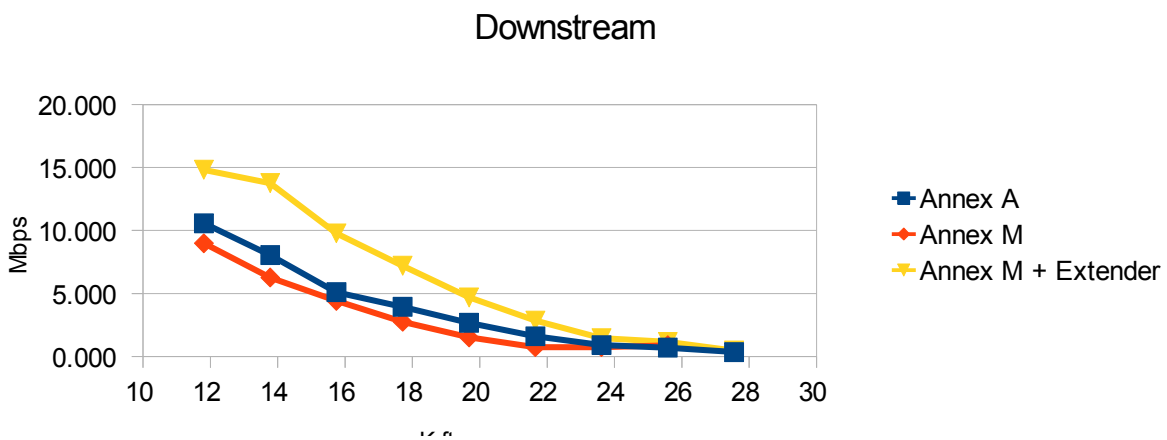
* All speed/distance figures in this paper are based on 24 AWG wire.

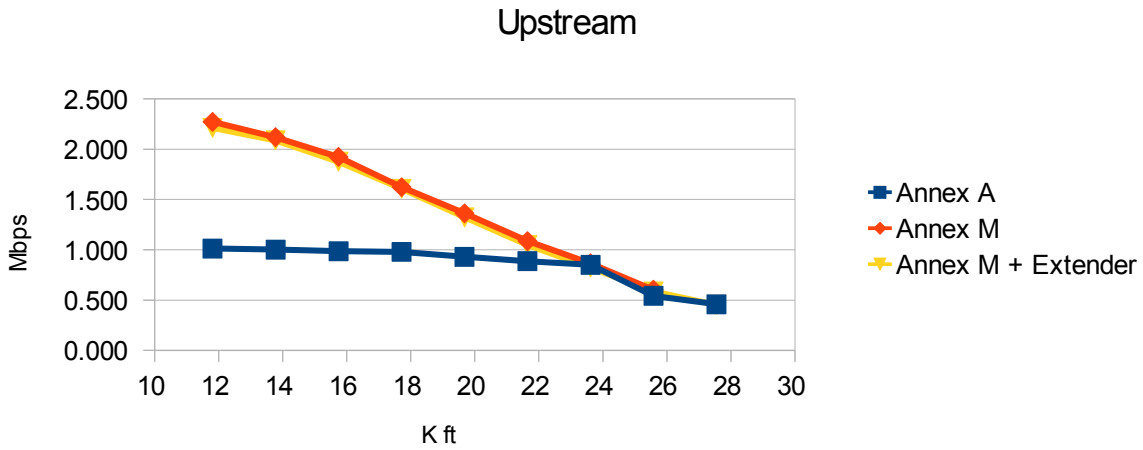
Rate-of-return carriers receiving legacy universal service support, or CAF support to offset lost ICC revenues, must offer broadband service meeting initial CAF requirements, with actual speeds of at least 4 Mbps downstream and 1 Mbps upstream, upon their customers' reasonable request. Recognizing the economic challenges of extending service in the high-cost areas of the country served by rate-of-return carriers, this flexible approach does not require rate-of-return companies to extend service to customers absent such a request. - FCC executive summary

Any (price cap) carrier electing to receive the additional support will be required to deploy broadband and offer service that satisfies our new public interest obligations to an unserved location for every $775 in incremental support. - FCC executive summary

Price cap carriers (larger ones including. Bell Operating companies) eligible for the $775. Whereas, it seems Rate of return carriers are required to do it if they get a reasonable request. Only one carrier gets funding for an area. --sv

Perhaps the biggest surprise is that the FCC plans to increase its 4 Mbps downstream- 1 Mbps upstream minimum broadband target speed in Year 5—at least in some portions of price cap territories. The higher target speed would be 6 Mbps downstream- 1.5 Mbps upstream "to a number of supported locations to be determined in the [cost] model development process," the FCC said. Also by Year 5, broadband Universal Service recipients would be expected to have met the 4/1 Mbps speed target throughout all price cap service areas. By Year 3, recipients in price cap areas will be expected to have brought 4/1 Mbps service to at least 85% of their service area. In its order, the FCC stopped short of specifying any target higher than 4/1 Mbps for rate of return areas. http://www.telecompetitor.com/universal-service-reform-order-yields-a-surprise-or-two/





The charts above show the maximum attainable rate vs. distance from the DSLAM under laboratory conditions – real world experience will be somewhat lower depending on the noise level of the cable plant. Since 1 Mbps upstream is barely attainable using Annex A under laboratory conditions, it is unlikely to be a robust service under field conditions. Annex M provides a robust solution for 1.5 Mbps upstream to 18 kft and 1 Mbps to 20kft. ADSL loop extenders increase the downstream speed at that distance to match the 4/1 and 6/1.5 targets.