

# Squeezing Copper into Delivering More

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The insatiable thirst of consumers for more broadband services (IPTV and high-speed Internet) continues to increase, and this, while today's economic woes push back on the installation of newer last-mile fiber solutions (FTTH). This reality is forcing service providers to pursue high-speed alternatives.

One convenient high-speed alternative to fiber is squeezing and enhancing DSL to support greater capacity broadband services; this is known as bonding. Bonding is covered by multiple ITU-T standards depending on Ethernet or ATM implementations (G.998.x). Bonding ADSL2+ and/or VDSL2 allows service providers to reuse their copper infrastructure and to offer higher speeds within a given serving area, or to expand their reach to new areas, to attract more customers with high-speed package service offerings.

## THE CHANGING ENVIRONMENT

Traditional DSL offers a 1:1 capability, that is, one DSLAM port to one customer modem over a single copper pair, and bonding the DSLAM means doubling the capacity using two ports over two copper pairs. Converting the typical DSLAM to bonding is a question of loading new firmware/software into their field-programmable gate arrays (FPGA) and DSPs to couple together two existing DSL ports. The biggest change is to the customers' modems, since they only contain a single-port DSL chipset. To adopt bonding, a customer's modem must change to make use of dual chipset capability to capitalize on the two pairs into the subscriber premises.

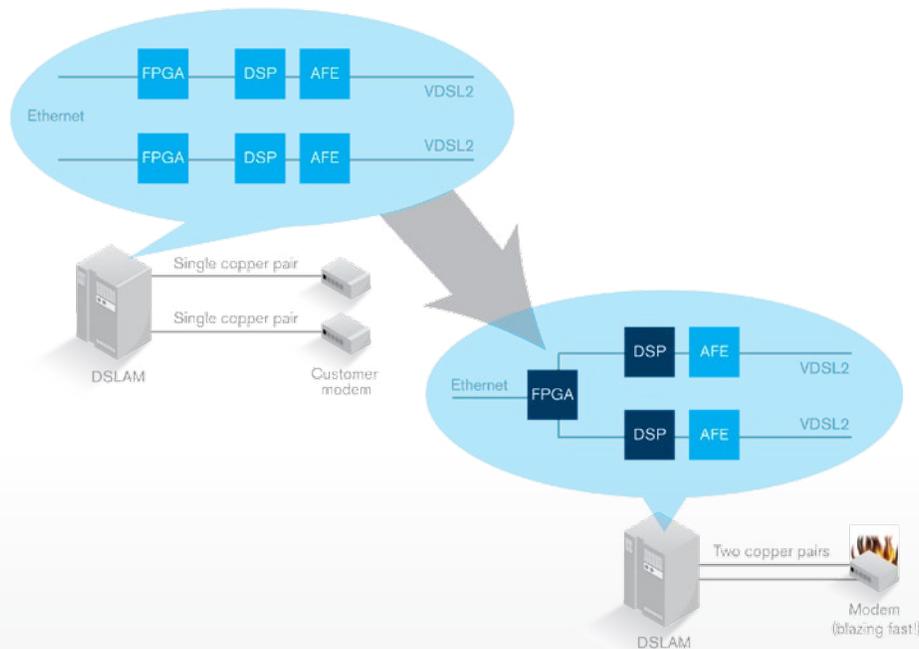


Figure 1. To support bonding, the DSLAM and CPE modem need new hardware and/or firmware.

Doesn't a service provider only have so much copper? Yes, of course. However, over the last decade, service providers have been losing landline voice customers to mobile operators and now have unused copper pairs. By supporting bonding, not only is the service provider recovering from lost voice revenue, but they have the potential to increase their revenues substantially by offering bonding. Bonding can attract new customers or influence existing customers to subscribe to new service offerings.

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## DELIVERING MORE WITH BONDING

The key application is IPTV. Bonding allows service providers to boost their IPTV service by either offering more bandwidth or greater distance. The table below highlights the possibilities comparing single-pair VDSL2 to that of bonded ADSL2+ and bonded VDSL2:

Going the Distance	Single-Pair VDSL2	Bonded ADSL2+	Bonded VDSL2
Three HD IPTV channels	21 Mbit/s	21 Mbit/s	21 Mbit/s
Two SD IPTV channels	5 Mbit/s	5 Mbit/s	5 Mbit/s
High-speed Internet	6 Mbit/s	6 Mbit/s	6 Mbit/s
Total bandwidth	32 Mbit/s	32 Mbit/s	32 Mbit/s
Typical maximum deployment distance	1.2 km (4000 ft)	<b>2.4 km (8000 ft)</b>	<b>1.8 km (6000 ft)</b>

Keeping It Close to Home	Customer at 1.2 km Using Single-Pair VDSL2	Customer at 1.2 km Using Bonded ADSL2+	Customer at 1.2 km Using Bonded VDSL2
Number of HD IPTV channels	3	4	6
Number of SD IPTV channels	2	2	2
High-speed Internet	6 Mbit/s	12 Mbit/s	18 Mbit/s
Total bandwidth	32 Mbit/s	<b>45 Mbit/s</b>	<b>65 Mbit/s</b>

With service providers trying to meet subscriber expectations on bonding, there is one truth that does not go away, and that is, the need for testing the physical copper, the DSL layer and the application (multiplay) layer. Utilizing traditional test solutions is good, but test solutions that only focus on single-pair copper/DSL deployments can only provide half the information. Factors like noise, crosstalk, bridge taps and other faults (e.g., shorts, grounds and bad splices) may have been fixed for single-pair deployments, but the second pair also needs to be cleared of these faults to ensure quality-bonded DSL deployments. Likewise, testing one pair at a time for DSL does not provide enough detail for the bonded group and each pair's unique interaction—once bonding is supported.

## THE SOLUTION

EXFO's MaxTester 630 DSL tester makes bonding DSL qualification during installation and repair extremely easy. Multipair support allows the technicians to be efficient in their job-to-job testing and increase first-time-right results. Utilizing the latest generation of Broadcom chipset, the MaxTester 630 is the perfect installation and repair xDSL tester for any technician working on networks using the latest DSL technologies, such as bonding and vectoring.



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