Turning Copper to Gold with Intelligent Switching

How telcos can extend the value of their legacy copper while moving toward FTTH

Today's fixed-line telco networks are undergoing a constant infrastructure evolution. Operators are under increasing pressure to balance customer demand for more bandwidth and faster services with their own need for accelerated deployment and greater cost-efficiencies. All the while, they are facing fierce competition from a variety of broadband access providers—fixed wireless, coaxial, satellite, power lines and more. In this dynamic environment, those who aren't moving forward, risk falling behind.

The vision everyone is chasing is an all-fiber network, from the central office to the premise. With virtually unlimited bandwidth and the potential to be highly automated, an FTTx network is agile and virtually future-proof.

According to The Fiber Broadband Association, all-fiber deployments in the U.S. are on pace to hit about 50 % of households by 2025.[i] France is even further along. As of June 2019, it had run fiber to 15.58 million of 34.5 million homes[ii] and expects to increase this to at least 80 % of all households by 2022.

As global Tier 1 service providers push fiber deeper into the access network, most have made it to the distribution point (FTTdP) or the cabinet (FTTC). But the last few hundred meters, from the cabinet to the premise is costly for the operator and disruptive for subscribers. Hesitant to go all-in on FTTH, Tier 1 operators are choosing instead to close the gap incrementally.

For many telco networks, the next step toward FTTH involves upgrading their legacy analog copper between the curb and premise to support faster, digital services. By adapting the active equipment (DSLAM or MSAN) for xDSL techniques like VDSL2 and vectored VDSL2, operators can maintain adequate bandwidth (30-50 Mb downstream) and still offer competitive pricing. It also enables them to extend the value of their legacy copper plant.

Still, the process of updating to faster, copper-based broadband presents significant challenges. It means physically disconnecting, moving and reconnecting the copper cables. Where xDSL splitters are involved, the complexity and amount of copper to be relocated increases. All of this requires truck rolls and manual intervention that could easily cost $200 to $350 per subscriber, not counting the cost of service downtime, potential manual errors and, ultimately, higher churn.

Moreover, each subscriber line must be reconfigured individually once the customer decides to take the new service. Depending on the operator's service load and schedule, it could take several weeks

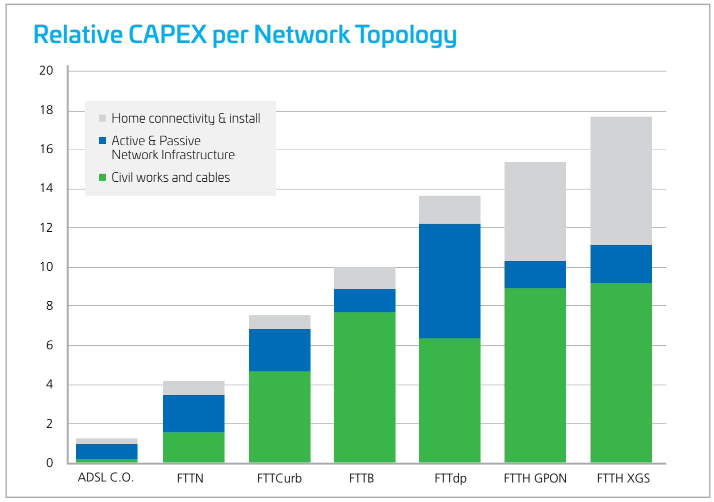

Figure 1

for the subscriber to receive the new service. Recently, CommScope engineers have developed an innovative solution that enables operators to easily upgrade—DSL to IP broadband, from the cabinet to the customer premise—at the flip of a switch without having to rip and replace their legacy copper lines. A modular, high-density design supports mass service changeovers without expensive truck rolls and eliminates customer issues due to manual interventions and long wait times.

LSA-PLUS® HDS

The LSA-PLUS HDS is a high-density, modular copper connectivity platform that installs quickly and easily at the street-level cabinet. The platform is based on the established LSA-PLUS technology (Figure 2), a universal solution for connecting and shielded/unshielded, two- or four-wire copper cables in telco networks.

Figure 2

LSA-PLUS uses a multi-functional sensor insertion tool, enabling installers to connect cable leads without soldering, wire-stripping or the use of screws, eliminating the common sources of interference for copper connections. Ensuring a correct insulation displacement connection prevents corrosion, loosening caused by vibration, high-resistance joints and a weakening of the wires.

The HDS remote switch version is a plug-and-play module that connects to the LSA-PLUS HDS connectivity platform. The module features two intelligent relays along with high-pass and low-pass filters. A pre-connectorized cable head accommodates 48/64/72 or 96 copper pairs and is compatible with a variety of cable connectors specified by MSAN vendors. The HDS module also features optional integrated 230 V over-voltage protection and fail-safe.

The LSA-PLUS provides the easy, reliable connectivity, while this specific HDS version performs the intelligent, no-touch switching when it is time to upgrade the service.

Innovation born of necessity

As operators continue to push fiber deeper into their access networks and closer to the customer, cost is not the only issue threatening success. Networks are increasingly having to manage the potential for disruption to customers. At the heart of the issue is the effect of change on customers—even when it portends faster, better and more reliable service. Whether the change involves running fiber over the last few hundred meters or upgrading their copper drops from analog to digital, operators are quickly recognizing the need to manage the transition in order to minimize impact on the customer.

Specifically, network improvements between the street cabinet and subscriber premise mean truck rolls, planned outages, limited access to streets and homes, and, in some cases, additional customer fees to cover the cost of the upgrades. The price to the network can be measured in higher OpEx as well as increased customer churn.

In 2018 a European telco was preparing to upgrade its copper-based DSL service to a digital xDSL technology within parts of its network. Realizing the direct and indirect costs of a rip and replace, the operator challenged CommScope to design a more elegant solution. The result was the LSA-PLUS HDS Intelligent Switch.

The schematic in Figure 3 illustrates a sample configuration for the HDS module. Here, the system receives input from the DSLAM or MSAN. Before any service upgrade, the system routes the signals through the high-pass filter and a low-pass filter to the existing active customer line.

When the operator and customer are ready for a service upgrade, the HDS module automatically re-routes the new digital signal directly towards the active customer line.

The switch relay is sensitive to changes in voltage. When the signal to a DSLAM or MSAN port changes from analog to digital, the relay automatically senses and responds to the shift by re-directing the new digital signal straight between DSLAM and customer line. As a result, the operator can upgrade individual subscribers as they migrate to faster services, or they can switch over hundreds or thousands of customers with a mouse click.

Because the switch is controlled remotely, the operator can turn the filters on or off to perform maintenance procedures such as error line identification. The relay is also designed to allow temporary galvanic access to the subscriber line to support Integrated Line Test Function (ILTF). Additionally, by putting the system into temporary sleep mode, operators can perform end-to-end line testing from the central office. The platform also supports xDSL splitter functionality.

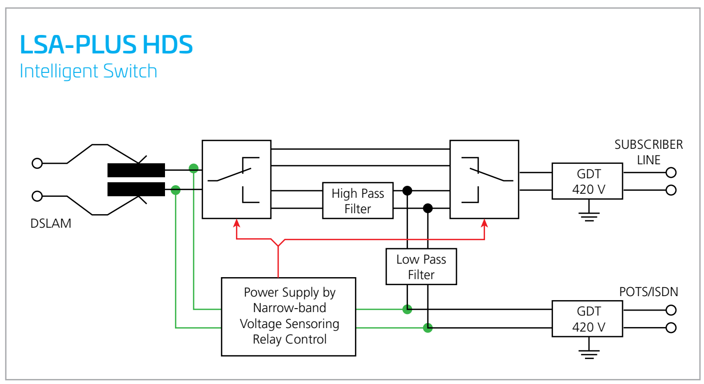

Figure 3

Benefits and opportunities

While the LSA-PLUS HDS platform delivers important benefits to help operators improve their near-term efficiency and subscriber satisfaction, it also positions the network for a well-balanced transition on its journey to an all-fiber infrastructure.

As stated earlier, the transition to FTTH will occur over several years and involve various generations of active equipment and multiple xDSL technologies. As illustrated in Figure 4, each technique can be mapped according to CAPEX versus

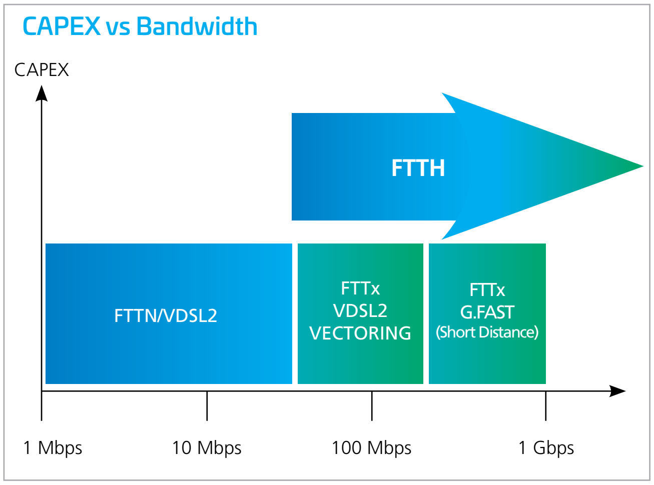

Figure 4

throughput speed. It is hoped that the switch to enhanced FTTx technologies—like VDSL2 Vectoring, G.Fast—will provide one of the final bridges to all-fiber FTTH.

Still, making the incremental jump to enhanced copper performance involves many challenges. For example, the process will include a significant number of moves/adds/changes (MACs) within the copper plant and especially inside closures, cabinets and boxes. The value of intelligent connectivity platforms is their ability to automate many of these MACs. This not only saves costs in personnel and truck rolls, but it also enables operators to accelerate upgrades and minimize service disruption for customers.

The effects of electrical disturbances on signal quality pose another interesting challenge. Where legacy copper runs extend for several kilometers, the results of electrical disturbances—from lightning, power lines or induced power switching—typically dissipate before causing any noticeable damage to active equipment. As the final copper run to the premise shrinks, those same electrical disturbances pose a more significant threat, especially to sensitive devices such as DSLAM/MSAN. Platforms like LSA-PLUS HDS that incorporate optional line-by-line overvoltage and overcurrent protection can help minimize potential damage.

Managing decommissioned copper

As telco networks continue to evolve toward an all-fiber architecture, operators are now considering how best to monetize their remaining copper plant. Thus far, we've discussed maximizing the value of the active copper running from the cabinet to the premise. Many networks, however, still own a significant amount of inactive, in-ground copper, both trunks and drop cables; even more can be found inside the central office and the hundreds of shelters, cabinets and closures located through the network. The decision of whether to reclaim or sell it is made on case-by-case basis. One popular use case for leaving the cables in the ground is power distribution.

Another factor driving the discussion is the trend of pushing central office functions toward the edge of the network, aligning their network topology with new edge-based fiber POP locations. As this happens, more and more of the inside copper infrastructure is being decommissioned. Operators cannot decide how to manage their inactive legacy cabling without addressing the bigger question of whether, and how, to vacate these valuable real-estate assets.

In the near future, there will still be a need for some legacy copper inside the shelters, cabinets and enclosures. But where a significant amount of in-ground copper remains, the challenge will be picking the relevant copper pairs out of massive in-ground copper cable trunks.

Increasing the potential of your remaining copper infrastructure

According to Panda Security, the world's fastest internet service is found in Taiwan, where average download speeds top out at 85.02 Mbps.[iii] The top European country is Sweden (55.86 Mbps), while the U.S. clocks in with an average download speed of 32.89 Mbps. These are speeds that any xDSL technologies can easily sustain and exceed. So, for now, fixed-line telco operators are in no great hurry to commit to an all-fiber upgrade. Taking the incremental step to faster copper-based service enables networks to maximize the value of their existing legacy cabling for the next several years at the least.

While intelligent switching solutions are proving successful in the field, development is still in its infancy. Yet one of the early lessons is that platforms like CommScope's LSA-PLUS HDS have the potential to fundamentally change the way operators manage and prepare their networks to transition into the next generation of fiber-deep design.

[i] All-fiber deployments to 90% of U.S. households achievable by 2029; FierceTelecom; September 16, 2019

[ii] Broadband and Superfast Broadband Market; ARCEP; September 6, 2019

[iii] Working Abroad: What Countries Have the Fastest Internet?; Panda Security; December 13, 2019

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