



Distribution Architecture:

Hardened Connectors vs. Field Splicing



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Making cost-sensitive decisions about deploying FTTX architectures requires service providers to not only look at initial installation costs, but to also peer into the future regarding operational and maintenance expenses following service turn-up. Cost modeling allows the deployer to review the financial benefits of their design choices before deployment begins. This paper specifically addresses the cost comparisons between using hardened connectors vs. splices in two basic areas of the FTTX network – the distribution plant and drop cable portions.

Cost savings can be achieved on both sides of the service terminal by installing hardened connectors. Although most network architects agree that hardened connectors are optimal for the drop side of the service terminal, many are unaware that the cost on the distribution side is also at cost parity or, in many cases, lower when using connectors in lieu of splicing. The result is an overall lower installed cost for the FTTX network as well as tremendous operational savings over the life of the network.

Large cable and splices

In many typical FTTP architectures, a very large distribution cable containing 48 to 216 individual fibers is deployed from the Fiber Distribution Hub directly to the service terminal. The service terminal could be a splice case, a pedestal, a hand hole, or mounted on a pole. In the case of a spliced network, between one and 12 fibers will be prepared inside the service terminal for connecting to drop cables that service each individual home.

The remainder of the distribution cable will continue to the next service terminal where the next one to 12 fibers will be split off and made available for service. Each time service is ready to turn up at a particular home, a technician will go to the terminal, cut off the appropriate length of drop fiber cable from a large spool, and pull the cable from the terminal to the optical network terminal (ONT) on the side of the home, or vice versa, and splice both ends.

This requires two sets of workers – a construction crew to pull the cable to each location and a splice technician to prepare the cable for splicing. The splice technician will need to visit each individual service termination to prep out the distribution cable, even if splicing is not required at that time. It also requires another trip to the service terminal by a technician each time a drop cable is ready to be spliced in to provide service to a home. It's easy to see that a typical spliced approach requires more overall manpower costs and numerous trips to the service terminals by a larger number of experienced technicians. All of this adds to the start-up costs for the FTTX build-out.



A more economical approach

Using a hardened connector approach on the distribution side of the service terminal is less costly and requires far fewer splice technician deployments. In this architecture, which incorporates ADC's new OmniReach™ Multi-Fiber Service Terminals (MSTs), smaller cables--up to 12-fibers each--are extended from a centralized splice location to each service terminal. This eliminates running very large cables and accessing those cables at numerous locations. Even though the number of splices is about the same, all splices are done at one location, greatly reducing overall splicing costs. Typically, a large portion of splice cost is in the set-up. But with a central splice point, the splice technician sets up one time and splices as many as 12 smaller cables onto the distribution cable.

Additionally, there are no splice cases required at the service terminal, making the hand holes or pedestals that store the service terminals much smaller. This is beneficial from both a materials and installation standpoint. Also, many municipalities prefer smaller, less obtrusive pedestals or smaller hand holes that are easily placed and less expensive.

A cost model comparing the installation costs of the traditional spliced FTTX architecture with one that incorporates MST hardened connector technology in a 192-home subdivision is as follows: Using the MST model, cable costs decreased by over 85% due primarily to the cable now being included in the terminal costs. The cost of pulling fiber cables decreased by about 25% and splicing costs were about 70% lower. Even though the MST approach added additional costs for service terminals, the overall cost was significantly lower for the distribution side of the network – approximately 19% less per home passed.

The drop cable portion of the network – between the service terminals and the ONTs – also reaps many advantages through a hardened drop connector approach. The technician can simply use a pre-connectorized drop cable – pre-connectorized at both ends in the factory and cut to specific lengths – to install between the service terminal and the home. These cables can be installed by any technician, possibly the same

person connecting the electronics at each home. This greatly reduces the cost of drop cable installations in terms of time and skill level. A technician simply has to clean the connector faces at each end and plug them in.

The overall cost of using factory-connectorized drop cables in place of spliced bulk drop cable was at least 25% less. Since service providers can realize a combined savings of nearly 25% in the entire OSP portion of the fiber plant, the business case for the architecture that incorporates MST hardened connectors is compelling. But there's more – additional operational savings over the life of the network should also be considered.

Savings now and later

The operational cost savings gained from having a connectorized FTTX infrastructure becomes evident in terms of faster service turn-up, ease of maintenance and troubleshooting, the need for fewer splice technicians/equipment, and overall fewer truck rolls. But through extensive cost modeling, ADC is showing that the cost savings can be achieved at the onset of building the network.

Installation cost modeling has shown that a spliced approach is far more expensive than a hardened drop connector approach. Splicing is simply a much more expensive undertaking without a centralized splicing location. More locations, more splices, and the need for more splice technicians greatly increases initial installation costs in the network.

In the hardened drop connector system, troubleshooting can be done at the service terminal simply by unplugging a connector. The spliced approach requires breaking a splice or going directly to the side of the home to investigate problems. There is less need for splicing equipment, particularly in larger installations.

Despite arguments that connectorized approaches result in more optical loss and also require more inventory and slack storage provisions, the data outlined above still reaches the same overall conclusion – the hardened drop connector approach incurs lower overall installed costs for the FTTX network.

Spliced Approach		Hardened Drop Connector Approach	
Hand-Hole Costs	\$ 10,000.00	Hand-Hole Costs	\$ 11,194.00
Cable Costs	\$ 15,000.00	Cable Costs	\$ 1,538.00
Cable Placing Costs	\$ 75,000.00	Cable Placing Costs	\$ 56,650.00
Splicing Costs	\$ 9,072.00	Splicing Costs	\$ 2,988.00
Terminal Costs	\$ 0.00	Terminal Costs	\$ 16,072.00
Total Costs	\$ 109,072.00	Total Costs	\$ 88,442.00
Cost/ Home Passed	\$ 568.08	Cost/ Home Passed	\$ 460.63

Specific cost model based on a phased project for a 192 home subdivision, featuring eight homes per block.



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