The Dynamic Access Network: Expandable, Flexible, and Accessible

BY JOSH SIMER

We all know that our industry is characterized by the rapid growth of data traffic and by constant change in how that traffic is managed. Conversely, though, many parts of our industry are also characterized by tradition, regulation, and procedure – most notably the physical layer. In fact, we might visualize this as a sort of inverted pyramid, where Layer 7 is the one characterized by the most rapid change and adaptation, and Layer 1 is characterized by the least.

There are good reasons for this. Layer 1 infrastructure, especially the access network, takes a long time to install, is expensive, and requires the most planning and coordination. For these reasons, we tend to view the physical access network as a fairly static component of the network model: install it and keep using it as-is for a generation.

But it is time for this attitude to change.

With the advent of 5G – and more importantly, with the usage cases that 5G helps enable – the capabilities and demands of these usage cases and applications will increasingly affect how we must plan for the physical access network. The problem is that the reasons why the access network has been slow to evolve remain valid – expense, time, permitting, etc. So how can we do both?

The solution lies in designing, engineering, building, and provisioning access networks that have three key characteristics: expandability, flexibility, and accessibility.

Table 1. Example bill of labor and materials for access network installation

Inventory	Size / Type	QTY	Notes	Rate	Total	Total with 2X cable capacity
FDH	OPTICAL_SPLITTER	4	each	$550.00	$2,200.00	$2,200.00
SPLICING	ENCLOSURE	7	each	$300.00	$2,100.00	
SPLICING	ENCLOSURE (double capacity)	7	each	$450.00		$3,150.00
CABLE	FIBER_Cable_A	450	per meter	$3.50	$1,575.00	
CABLE	FIBER_Cable_B	2500	per meter	$4.50	$11,250.00	
CABLE	FIBER_Cable_A (double capacity)	450	per meter	$6.00		$2,700.00
CABLE	FIBER_Cable_B (double capacity)	2500	per meter	$8.00		$20,000.00
TERMINAL	Multiport terminal	27	each	$200.00	$5,400.00	$5,400.00
					$22,525.00	**$33,450.00**

Services	**Total**	
Design	$ 9,000.00	$ 9,000.00
Build	$ 44,000.00	$ 44,000.00
	$ 53,000.00	$ 53,000.00
TOTAL PRODUCTS & SERVICES	$75,525.00	$86,450.00

Incremental cost to double capacity at initial installation: **$10,925.00**

14%

As easy as 1-2-3

Expandability refers to the ability of a network to handle increased traffic in the future. The simplest way to do this is simply to deploy more fiber. There is an expense to this, though, in terms of increased cable purchasing and installation costs. Fortunately, vendors are mitigating this problem. New, compact ribbon cables enable the deployment of far more fibers than ever before in the same footprint. For example, it is now possible in many cases to deploy an 864-fiber cable in the same size pathway that used to accommodate 432 fibers. That means network operators can deploy twice the fiber, but still use the same duct, the same installation method, etc. Rather than pay 100% more for a 100% capacity increase, the total installation cost increases by a much smaller amount. New fusion splicing technology further reduces incremental installation time and costs.

For example, see Table 1, which shows a simplified bill of materials and services for an access network installation. Doubling the capacity of the cables and splice closures increases the costs by only 14%. This is because the newer compact ribbon cables allow the installer to use the same installation methods, duct sizes, permits, etc., to install this greater capacity in the same space. Also, newer splice closure designs allow that additional capacity to be managed in the same size handholes, which also avoids increasing installation costs. Splicing costs do not go up at this point because the additional fibers can be expressed through the closures, waiting for a future reconfiguration where they will be spliced.

By comparison, coming back later to add this additional 100% of capacity could, in the worst case, equal or even exceed the original installation cost. Clearly, if there is a possibility of needing that additional capacity in the future, it behooves the network operator to anticipate this and plan from the beginning. This is why expandability is so critical in physical access network design.

Flexibility refers to the ability of a network to adapt to changes. Having an expandable network – for example, an 864-fiber backbone versus 432 as mentioned above – does not necessarily solve all the problems. This is because the specific nature of network demands is hard to predict. What if a disruptive wireless service provider comes in and installs 5G nodes at certain locations, and is looking for fronthaul and backhaul services? Merely having those 432 dark fibers running near the locations does not help.

Fortunately, developments in splice closures, terminals, hubs, and other components provide modular and highly flexible solutions that enable the network to adapt. Does the customer need one fiber per location? 12? Two fibers, but with multiple wavelengths? With these network components, the network can be readily configured to accommodate a wide range of scenarios, ensuring that the network operator can accommodate the needs of future customers – even without knowing right now what those needs will be or where.

Accessibility refers to the ability of technicians to go in and make those network changes. It is one thing for a physical access network to be theoretically capable of adapting to accommodate new capacity demands, WDM, etc. But someone must go out and make those changes, preferably make them quickly, and do so without disrupting existing customers. Here, too, vendors now offer highly modular and craft-friendly network components to enable these capabilities. Certain splice closures, hubs, panels, and other components are designed so technicians can readily change split ratios, connect "pass-through" point-to-point fibers, install WDM modules, identify and splice various numbers of previously dark fibers, or perform any number of other tasks to reconfigure the network.

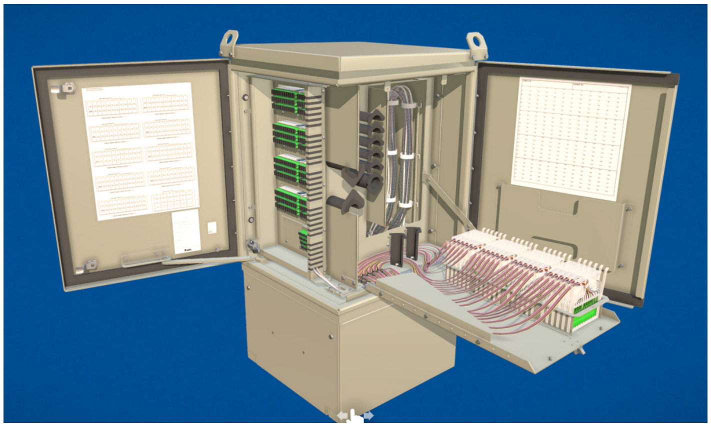

FIGURE 1. Modular component design.

Figure 1 shows an image of one network component, in this case a fiber distribution hub, illustrating how manufacturers can enable flexibility and accessibility in networks. The hub itself can support various split ratios, WDM, a mixture of point-to-point and PON connections, etc. – all at the same time. Its design allows technicians to easily come in and make those changes by swapping out components, reworking splices, adding pass-through connections, or whatever else is needed. A qualified design, engineering, and installation vendor can build a network to make maximum use of the flexibility and accessibility such a component offers. Time is money, and the ability of a network operator to implement changes quickly and effectively can make the difference in whether they can capture a new opportunity or whether it goes to a competitor.

In summary, we can no longer view the physical access network as a static part of our network model. The pace of change, and the likely pace of future opportunities, is too great for us to ignore the dynamic nature of physical access network demands. Network operators must consider this. They need to plan for expandability, flexibility, and accessibility in their networks, and they must seek out design/engineering/installation and hardware partners who can help them achieve this.

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