

## Service Product Offerings on a Middle-Mile Network

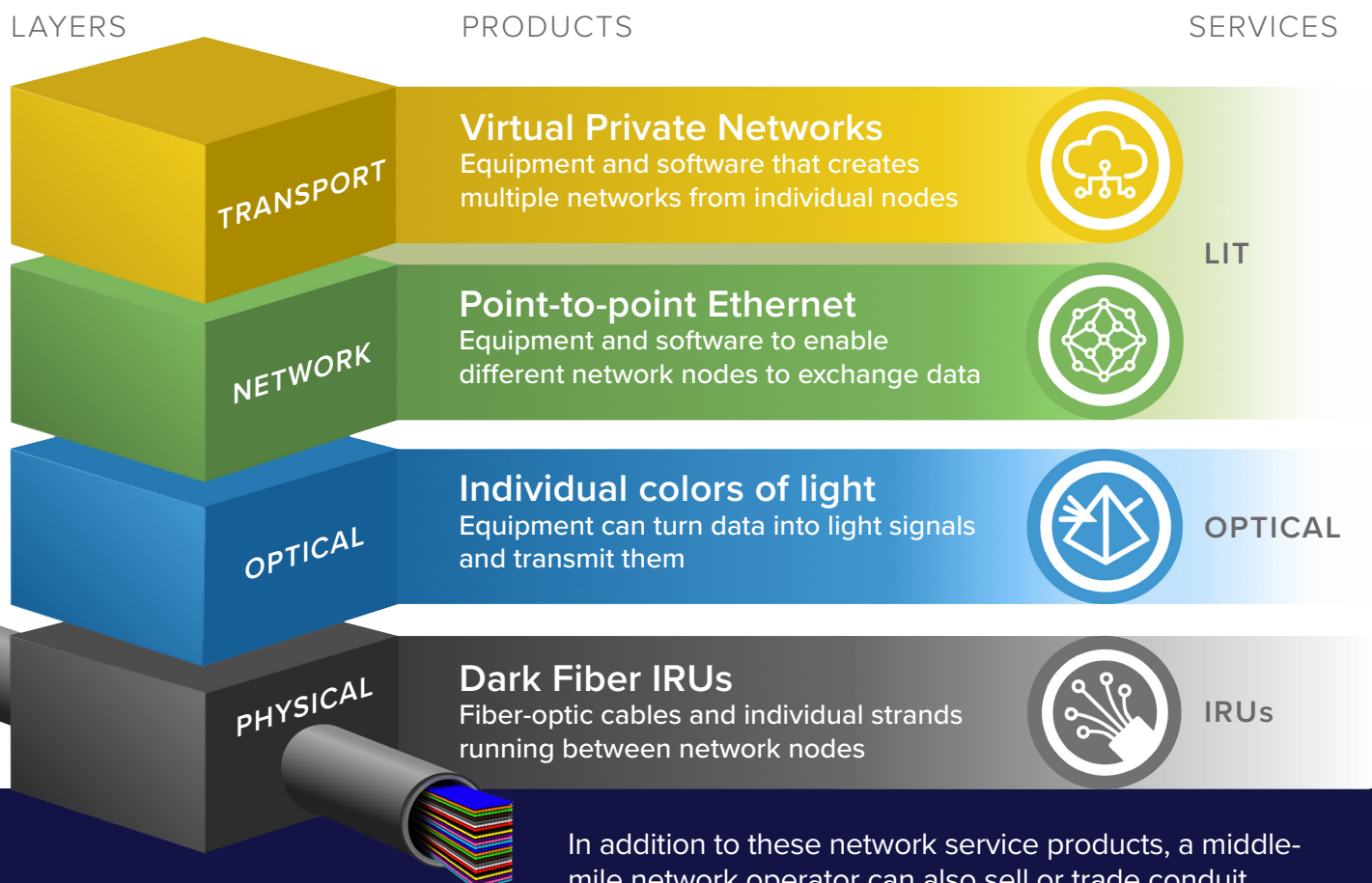
A statewide middle-mile network may consist of multiple layers of equipment and software to complete “handoffs” of data to and from last-mile providers, translate that data into light pulses sent over fiber-optic cable, and connect to the global Internet or cloud service providers like Netflix and Amazon Web Services.

However, not every last-mile-provider may wish to connect to a middle-mile network in the same way. Some may require greater capacity or seek greater control over services they create themselves and provide to their customers. Others may wish to connect their end-user customers to existing services and content providers.

Thus, if a middle-mile network operator is to attract last-mile providers as customers, it must offer a broad catalog of service products to meet an equally broad variety of needs well beyond the services offered by a typical Internet Service Provider.

## Multiple Layers of Equipment and Service Products

The different layers of a middle-mile network can be visualized literally from the ground up – starting with the medium over which the data travels to the equipment that sends the data and the software that governs that equipment and defines the networks that operate over it. Each layer requires the smooth, error-free operation of all layers below it, and last-mile Internet service providers may wish to purchase services at any or all of these layers from a middle-mile network operator.



In addition to these network service products, a middle-mile network operator can also sell or trade conduit space to other interested parties, rack space in network facilities (called colocation or “colo” services), and network engineering consulting services.

# The Middle-Mile Network and Service Offerings

The same fiber network can function very differently depending on the network layer on which a given service product resides.



## CREATING PRIVATE NETWORKS USING A MIDDLE-MILE NETWORK

Private networks residing on the Transport layer allow last-mile providers to create their own networks on the middle-mile infrastructure and connect to their own non-contiguous service areas as well as to other providers also on the network. Such connections can make use of carpool-lane like “express paths” along the backbone that enable the providers at either end of the path to connect to one another without their traffic having to transit every node between them.



## CONNECTING TO THE WORLD VIA A MIDDLE-MILE NETWORK

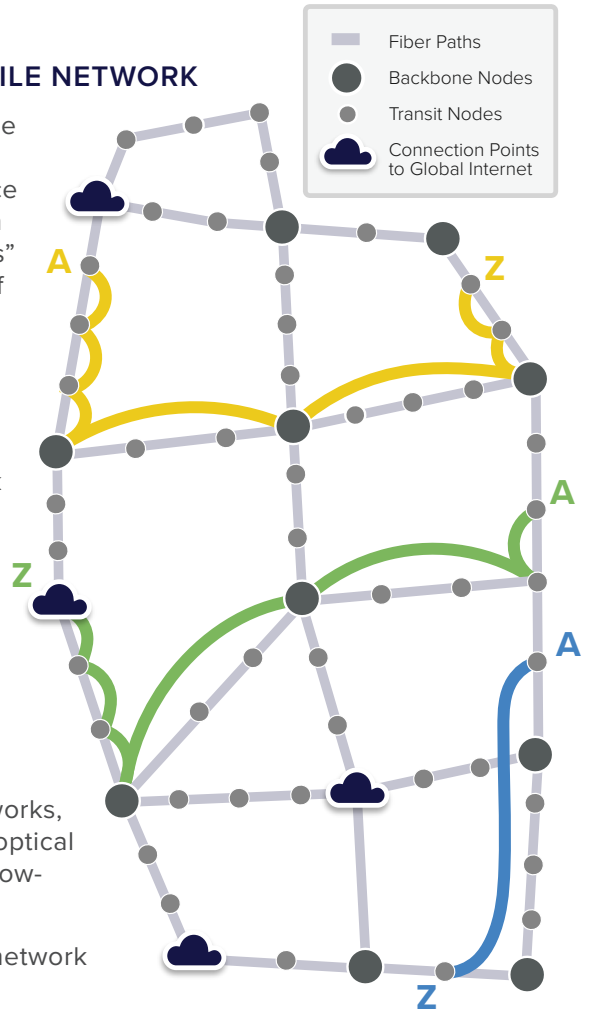
Ethernet and cloud provider services residing on the Network layer enable last-mile providers to connect their customers to the global Internet beyond a middle-mile network. Such connections also use backbone “express paths” that enable last-mile providers to connect the customers on their own networks directly to global Internet connection points as shown – ideally, to more than one.



## DARK FIBER AND OPTICAL SERVICES

Carriers can use dark fiber IRUs and optical services, such as spectrum service to add dedicated capacity to their own networks, to make their network more resilient by adding additional all-optical paths to expand their footprint, or to create customized very low-latency services of their own.

These services consist of specific paths along a middle-mile network Physical layer, with amplification where needed.



# Dark Fiber and Lit Services: Resources and Revenues

While last-mile providers can purchase service products from a middle-mile network operator at all layers of the network, smaller providers may find it challenging to purchase dark fiber IRUs or optical services, since creating custom services at lower layers requires significant investments of time, money, and resources. However, the revenue potential of these services is also greater.

### Purchasing a Lit Service

- Restricted in their ability to custom-configure their service for their end-user customers
- Requires less investment in equipment and expertise on their part
- Less potential for revenue
- Can be put into production much more quickly

### Purchasing an IRU or Optical Services

- Can offer a more customized, higher-capacity service
- Requires greater investment in equipment and expertise to light the fiber and create/maintain their network and services
- Potential for greater revenue
- Takes more time to put the service into production