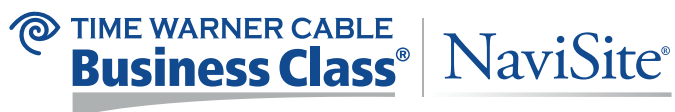# NETWORK DIVERSITY:

Can't Stop the Signal

An Independent Analysis Published on Behalf of Time Warner Cable, Inc.

EXECUTIVE SUMMARY

In today's connectivity services market, enterprises have many different options – fiber, copper, coaxial, microwave – and all of those combined. One key thing to remember when sorting through the various options is network diversity. This term refers to connections into an enterprise that are physically separate from one another.

Assume, for example, that telecom provider X owns a local, metro and long-haul fiber network and sells connectivity services to enterprises and business customers. Provider Y wholesales X's network and resells its own connectivity services to enterprises. In this simple example, there is service diversity since X and Y are different companies, but there is little network diversity since the infrastructure over which the packets travel is the same.

Next, consider provider Z enters the market and builds its own network completely independent of X's. This network would likely be different down to the street level. For example, Provider Z might string its fiber along poles while X's network is buried in conduit beneath the street. If a storm hits and knocks down Z's poles, then X's network is unlikely to be affected. Conversely, if a backhoe operator cuts X's conduit and the fiber within, then Z's network is unlikely to be affected.

All communications networks are engineered to provide near-instant failover in the case of a fiber cut or other interruption. However, in this example, it is true to say that provider Z's network is diverse from X's. And this type of network diversity may be extremely important to businesses or other organizations that must absolutely have disaster-proof communications. In fact, this level of network diversity/redundancy is typically seen as an "industry standard" in fields such as financial services, medical/hospital, government (state and federal), homeland and national security, etc.

This paper briefly discusses the concept of network diversity, how service diversity is different than actual network diversity, the different types of network and service providers in the market, and why network diversity is important.

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THE NEED FOR NETWORK DIVERSITY

A common term in the telecommunications world, network diversity essentially means that an organization will be able to communicate no matter what happens to the physical infrastructure over which those communications are transmitted. More concretely, network diversity refers to separate physical connections into the enterprise, and in the last-mile, metro network and long-haul networks.

Having a diverse network helps protect an enterprise's connection out to the world, all the way from the telecom/IT closet and out into the wider network. Think of network diversity as connection redundancy in the case of failure in a network provider's physical infrastructure. Network failures happen for any number of reasons: bad weather, accidents (a car runs into a telephone pole) or a company digging up the street accidently cuts fiber conduit. All network owners plan for their network routes, which are typically fiber, to get cut at some point - they build redundancy into their networks.

CONNECTIVITY PROVIDERS

There are many types of network connectivity providers – incumbent local exchange carriers (ILECS), competitive local exchange carriers (CLECs), cable multiple-system operators (MSOs), long-haul network providers, Internet service providers (ISPs) and mobile network operators (MNOs). Many of these companies do not fit neatly into these categories, since several of them provide multiple types of services over multiple types of network plant. Other types of companies, such as Zayo, currently specialize in providing physical plant (and Ethernet connectivity) to enterprises and carriers alike. Companies such as AT&T, Verizon, Comcast and Time Warner Cable, all offer a variety of connectivity services to a variety of customers – consumers, enterprises and even other network operators.

One key distinction with respect to network connectivity is between who actually owns the physical plant and who resells it. ILECs typically own their networks. CLECs typically resell the ILEC's infrastructure. Similarly, cable MSOs typically own their networks. These distinctions are somewhat simplified, but are true enough for the purposes of this paper.

Another key distinction is that the ILEC's physical network – last-mile, metro fiber rings and long-haul network – is separate from the cable MSO's. In a manner of speaking, their networks are diverse from one another. In this context, then, does a CLEC provide network diversity?

The answer is: It depends. Typically, a CLEC resells an ILEC physical plant. The CLEC

CONNECTIVITY PROVIDERS (*cont'd*)

Figure 1:
Multiple Networks, Multiple Operators
Source: TWC, 2015
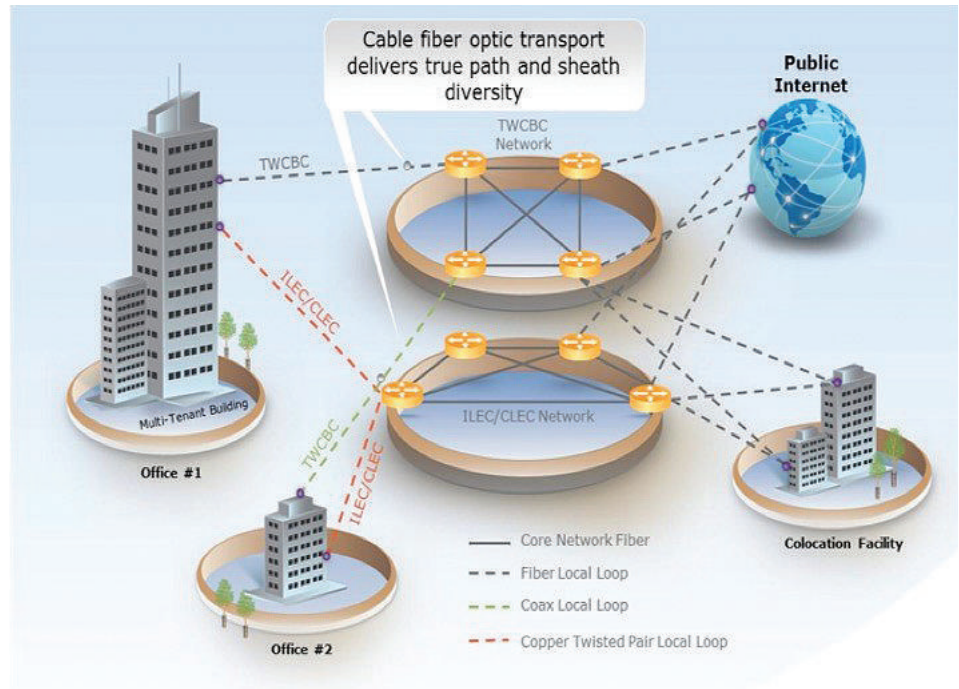
may be providing competitive services and pricing, but many CLEC services run over an ILEC's physical infrastructure that the CLEC leases. A CLEC may also have its own physical plant in some areas (for example, data centers) but use ILEC connectivity to link to the customer premises.

The above chart illustrates (in a simple way) the different types of networks available in a metro area. Note that TWCBC refers to Time Warner Cable while ILEC/CLEC could refer to the "telco." The chart does not show the networks of companies such as Zayo, which build their own metro fiber loops and also pull fiber directly to buildings. A competitive provider, such as Zayo, would be represented by a third network layered on top of the others. Finally, both a cable MSO such as TWC and an ILEC such as AT&T or Verizon, will also pull fiber to buildings – a process

which is colloquially referred to as "lighting up" a building.

There are several key points to be made from the above chart:

- CLECs may provide service diversity but not network diversity if they are using ILEC plant. As such there is not necessarily any benefit to using a CLEC for disaster recovery and network outage.

- Any CLEC, ILEC or cable MSO can and will provide multiple redundant routes into an enterprise or building if their customer requires it. This redundancy would extend throughout the network (metro and long-haul). But, the CLEC still provides its services over the ILEC's network. So anything that

happens to the ILEC's network may also happen to the CLEC'S network.

- A cable MSO's plant is physically separate from the ILEC/CLEC network even down to the street/ route level. For example, a cable MSO might string its fiber in the communications space on poles while the ILEC/CLEC might have its network buried beneath the street.

WHAT IS NETWORK FAILOVER?

Assume an enterprise has purchased connectivity services from an ILEC/CLEC. Typically, there will be two different routes for that company's communications traffic. Call them A and B. If route A fails, then the communications streaming over A immediately moves over to route B. This alternate path may be a separate fiber in the same bundle as the failed fiber or an entirely separate fiber route. Note that the connectivity provider has route protection built into its offering.

Mean time to recovery is a key metric in this topic since the faster the failover happens, the less downtime (if any) is experienced. Sub-50ms failover is a common benchmark.

"Five nines" reliability is another common benchmark that highlights uptime or connections that are highly reliable (i.e., downtime of less than 5.26 minutes per year).

Regardless of how redundant the loop is, an ILEC's/CLEC's fibers all terminate at the same location in their network – the local colocation facility. Hence if there is a physical failure at the local colocation facility, the enterprise will lose service, no matter how many separate fiber routes exist from the colocation to the building.

MOVING TOWARD NETWORK DIVERSITY

For an enterprise buying connectivity services, reliability and redundancy largely take care of themselves. The provider will offer service level agreements, minimum mean time to recovery thresholds and, likely, "five nines" uptime. If the connectivity choice ends up being between a CLEC or ILEC, then there is really only one network being offered – the ILEC's.

If an enterprise requires complete network diversity, then considering a cable MSO's connectivity services or a fiber Ethernet provider's services makes sense. Either network will be physically separate from the ILEC/CLEC.

The following chart illustrates TWC's long-haul fiber routes, its metro networks and the redundancy of those long haul routes. So, traffic originating in Dallas, for example, has several different routes to New York. Of course any connectivity services provider will offer that, but the cable MSO's network does not share physical plant with an ILEC as a typically CLEC does.

MOVING TOWARD
NETWORK DIVERSITY (*cont'd*)

Figure 2:
Time Warner Cable, U.S. Network Map

Source: TWC, 2015

Time Warner Cable - Proprietary and Confidential
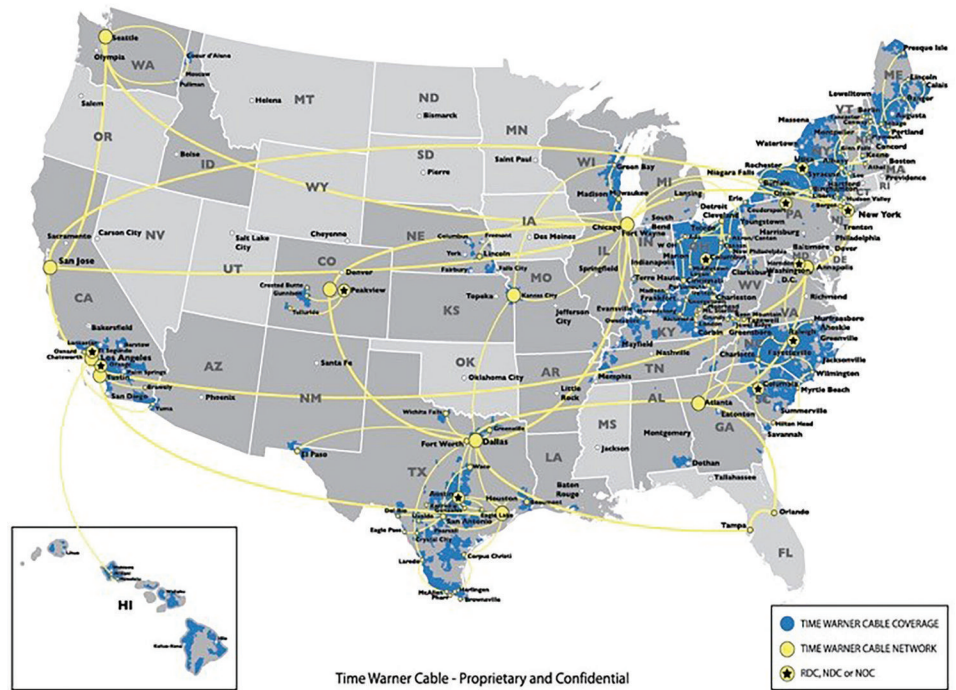
TWC has a footprint of 12 data centers across the U.S. and Europe and has more than 850,000 on-net buildings. Moreover, TWC's network is a highly redundant, secure and reliable hybrid-fiber coaxial network that spans more than 350,000 route miles in the U.S.

From a network diversity standpoint, the TWC network is a viable primary and alternate-path option to traditional communications networks. Put another

way, the benefit here is true route diversity particularly when TWC is used in conjunction with an ILEC/CLEC. TWC's network is likely to remain up even if the ILEC/CLEC network goes down. True route diversity is typically seen as an "industry standard" in fields such as financial services, medical/hospital, government (state and federal), homeland and national security.

About Time Warner Cable

At TWCBC, we know the path to success begins with a deep understanding of your business challenges and requirements. That's why we have a dedicated account team that will work with you to assess your needs, and then to recommend customizable, scalable solutions that best help to meet your demands.

Our complete suite of enterprise-class business solutions include Internet, Voice, Television, Network Services and Cloud Services—helping enable you to work with a single-source provider for all your needs. Backed by our fiber-rich network and competitive SLAs, you can count on reliable connectivity from a trusted provider.

For more information on TWCBC's services, please visit business.timewarnercable.com.

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NaviSite, Inc., A Time Warner Cable Company, is a leading worldwide provider of enterprise-class, cloud-enabled hosting, managed applications and services. NaviSite provides a full suite of reliable and scalable managed services, including Application Services, industry-leading Enterprise Hosting, and Managed Cloud Services for organizations looking to outsource IT infrastructures and lower their capital and operational costs. Enterprise customers depend on NaviSite for customized solutions, delivered through a global footprint of state-of-the-art data centers.

For more information about NaviSite's services, please visit www.navisite.com.

About iGR

iGR is a market strategy consultancy focused on the wireless and mobile communications industry. Founded by Iain Gillott, one of the wireless industry's leading analysts, we research and analyze the impact new wireless and mobile technologies will have on the industry, on vendors' competitive positioning, and on our clients' strategic business plans.

A more complete profile of the company can be found at www.iGR-inc.com.