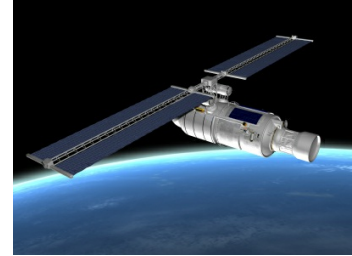


Network Trends for the Future: The Path and the Vehicle

By: James D. Taylor

During the early days of our telecommunications infrastructure, copper wires were the only pathway necessary to connect consumer communications needs. Voices speaking on either end of a telephone line, coupled to a complex network of switches transmitting an analog signal, were at one time the greatest accomplishment of the 20th century. Now, copper may be more valuable as the melted-down byproduct of a bygone era.



When I started at Lincoln Telephone Company in Lincoln, NE in 1990, the digital age was in full swing. During the 1980s, our company had undergone the task of burying our major distribution network—many routes with up to 12 fibers—to take advantage of the efficiencies of digital switching. Frame Relay was gaining momentum as a data service. Burying fiber also protected our network from the inevitable Nebraska winter storms, which included ice, which is unforgiving on aerial infrastructure. Cellular phones were in their infancy, in the form of either a bag the size of a small suitcase or a “brick” phone that looked like a refugee from World War II communications.

A DS1 (1.5 Mbps) circuit was considered a “big pipe,” only necessary for big business customers with lots of “access lines.” Eventually the DS1 was the standard bandwidth for connectivity of wireless towers for the operation of cellular phones. The DS1 was—and still is—transmitted via the existing copper infrastructure to enable voice and data transmission. Evolving technology and the data boom have caused communications needs to skyrocket exponentially over the past 20 years. And the boom is far from over.

As our communications infrastructure continues to expand to pacify consumers' growing wants and needs, the nation's primary mode of transmission has migrated more heavily to the fiber optic network. As development in hardware and software technologies have expanded network capacities, consumers and businesses have been enthralled in the need for speed. The speed of light. More data. Faster.

The common mantra for homeowners today is for “GIGABIT” to the home. By the way, a Gigabit of data is approximately 660 DS1s. That's some smokin' internet!

There are several technology trends that will continue to fuel the fire that leads to communications innovation. The keys to growth will be contingent upon two things: the pathway and the vehicle.

Pathways To The Future

The pathways to future growth are fiber, wireless and satellite communications.

The nation's fiber network is much like the Interstate Highway System. It courses on major routes, providing the pathway to the most populous areas for the transportation of goods and services to the major hubs and ports of commerce. When you get off the interstate, you encounter a network of freeways, highways, residential streets and dirt roads. The less populated the area, the less sophisticated the path. The fiber network is much the same. According to [BroadbandNow](#), [less than 25 percent](#) of the population in the United States has access to fiber-based services. Deployment of fiber is a continuous process, and it will continue until all copper cable is replaced, or until another medium (wireless?) replaces it.

Fiber is expensive to build. Right-of-way fees, permitting, and environmental issues (i.e. ROCK) are often barriers to expansion. Even more expensive is the maintenance and management of the intelligent devices required to keep it alive and growing. Some areas are difficult to access with fiber. At some point, the investment results in a diminishing return, as the pricing of services decreases in an effort to increase consumer demand. Broadband initiatives, on both the federal and state levels, will aid in deploying fiber to remote and underserved areas to fulfill the promise of economic prosperity via technology.

At some point, a hybrid approach is likely necessary to achieve “full” network connectivity. This approach involves deploying the appropriate medium for distribution, based upon the environment. A good example would be extending fiber to the neighborhood or “hub,” then distribution to the masses via wireless transmission. In some extremely remote areas, satellite will continue to be the most feasible medium for connectivity. If you can’t drive.... fly.

Vehicles To The Future

Ethernet Services

Ever since the birth of the Internet, we have continued to expand its ability to connect people and information. Back in the DS1 days, businesses connected remote locations to each other and the Internet via these little 1.5 Mbps connections (prior to that 56K modems). Today, the network has evolved toward Ethernet services, such as Ethernet private line (EPL), Virtual Private Line (EVPL) and Ethernet LAN (ELAN), moving data bandwidths from 5 Mbps to 1000 Mbps (a GIG). Beyond that, wavelength technologies have expanded bandwidth capabilities up to 400 Gbps. Now, 10 Mb Ethernet Private Line is the new DS1.

Software Defined Networking (SDN)

Another evolving concept is Software Defined Networking (SDN), and its offspring SD-WAN. This is the concept of making network capacity available “on demand.” SD-WAN is touted as a potential network solution for enterprise customers needing to connect remote locations in a secure network configuration. Providers promote its capability to utilize the existing Internet connection to establish a secure network connection, much like a Virtual Private Network (VPN) connection. If your pathway is dynamic—meaning you have access to the appropriate speed of broadband connectivity—it’s a feasible and scalable solution.

Internet of Things

The Internet of Things (IoT) remotely connects machines to machines for monitoring and automation. These machines may be your thermostat, your television, and your security system, all utilizing a network (either public internet or private line connection) for connectivity. Self-driving cars require a network of access points for operation. There are a multitude of applications that have been developed—or are being developed—to enable connectivity and productivity at a higher level.

5G Wireless

5G wireless technology is touted by some as the “holy grail” of wireless networking. While 5G has extraordinary capabilities for moving large amounts of data quickly via a wireless pathway, it still relies upon the network pipe (fiber) for its connection back to its source, likely a network router or switch. 5G is a likely candidate for distribution of video services and many other high bandwidth applications in small, densely populated areas. As 5G technology is deployed, more points of interface are necessary, in the form of towers, antennas, and access points for transmission and distribution. These access points are more commonly known as “small cells” and may be deployed in a variety of environments.

As technology continues to evolve, we must continue to build the infrastructure to meet the needs of network users everywhere. The fiber network will continue to expand, with the goal of expanding connectivity and, with it, economic opportunity. With this expansion, network security will continue to be a very important component to the equation, as users have a greater reliance on evolving

technology.

I am thankful and appreciative to have been a part of the telecom industry during this unprecedented period of technology innovation and growth. Many people I have met throughout my career have been truly inspiring with their passion for technology. As a rural network operator throughout most of my career, I take the responsibility for bringing technology and economic prosperity to those rural areas very seriously. I am proud to be acquainted with many small network operators who are extending fiber to homes, businesses and towers, making many positive contributions to the economic prosperity of the communities they serve.

The state of technology, innovation and network evolution is alive and well. I can't wait to see what we all do with 5G services and the development of the Internet of Things (IoT). There are certainly opportunities in video, security and agriculture, to name just a few of the industries ripe for tech innovation. We just need to extend the network.

The challenge is there, and we in the industry are eager to meet it head on. It's time to grab the brass ring and swing from it.