Chapter LV
Innovation and Utility in the Optical Transport Network

R.K. Koslowsky
Independent Scholar, USA

ABSTRACT

This chapter addresses the introduction of a Multi-service Provisioning Platform (MSPP) into the transmission segment of the communication network. The first company to do so was Cerent Corporation. Although it was initially introduced in the United States in 1998, acceptance was rapid, and MSPPs found there way into the balance of the world market shortly thereafter. MSPP innovation enabled both new and existing service providers to leverage existing optical transmission infrastructure with increased functionality. Introduction of MSPPs enabled the proliferation of Computer Mediated Communication (CMC) through the synthesis of traditional voice and emerging Internet traffic. The bandwidth bottleneck created by voice-only-based equipment was broken by the MSPPs and positioned the Internet for carriage of even higher bandwidth video traffic. The utility of the MSPP approach, as viewed by the telecoms, made it both a market success and a new standard to which all manufacturers adhere.

INTRODUCTION

Cisco Systems Inc. acquired Cerent Corporation and its flagship Cerent 454 product in 1999. The Cerent 454, retooled and branded as the Optical Networking System (ONS) 15454, continued to gain market acceptance in 2005, more than 6 years after its acquisition. In Cisco's 2005 annual report, optical product sales were reported to have increased by $150 million, driven by the ONS 15454 across both domestic and international markets[1]. The success of a new product class targeted for a typically uneventful segment of the telecommunications market that challenged competing global behemoths is impressive in itself. A more intriguing aspect is that the thought of developing an optical fiber transport system that customers were demanding–one for the metropolitan environment to support a variety of bandwidth capacities and service interfaces–did not germinate until Cerent arrived. A solution was needed to enable the proliferation of computer communications among multiple metropolitan networks using the Internet as the lifeblood of business connectivity.

The early 1990s oversaw the rapid build out of core optical networks. Long distance connectivity using railway right-of-ways, pipelines, and highway easements led to the crisscrossing of fiber routes across many countries. Regional fiber networks were built as collectors of bandwidth from major urban centers lit many of these fibers. Dense Wavelength Division Multiplexing (DWDM) was applied to these long haul networks to accommodate higher bit rate optical carrier (OC) signals (e.g., OC192), but more importantly, to combine multiple bit rate streams on a single fiber pair. The use of high bit rate systems and DWDM delivered significant cost savings for long distance service providers.

Local service providers began aggressively building out fiber networks in metropolitan areas to link central offices and provide umbilicals to large corporate customers with high bandwidth needs. Many of these early fiber connections were partially funded by these corporate clients in support of their local area networks. What was revealing about this driver was the explosion of bandwidth in the mid-1990s. Industry analysts correctly projected the explosive traffic demand in North America and the shift to higher levels of bandwidth service types. At the time, expected growth in traditional voice circuits was expected to range between 200 and 1,100%, as well as the appearance of higher bit-rate optical interfaces that needed to be transported across the metropolitan network[2]. Data professionals were obtaining OC3c and OC12c connectivity among locations for Asynchronous Transfer Mode (ATM) services. In addition to ATM and Frame Relay protocols, Ethernet interfaces such as 10BT, 100BT (Fast Ethernet), and 1000BT (Gigabit Ethernet) were required by other data managers to connect data processing and computing centers. Increasing local area network speeds required higher bandwidth connections across metropolitan networks.

In a few cases, dark fiber and optical wavelengths were beginning to be marketed by service providers to retain large customers building their own virtual networks. The need for security of mission critical data led many corporations to build data backup and storage facilities at alternate locations. New high bandwidth optical service interfaces began to gain acceptance as the new millennium dawned. In any case, the standard voice circuit currencies of exchange were no longer the only game in town and the more lucrative higher speed bandwidths needed to be added to the service provider portfolio. This became the major challenge for equipment suppliers to address–delivering products that could support multiple service interfaces and a variety of optical bit rates. Both low bit rate voice circuits had to be carried as well as computer-generated, high bit rate data traffic.

A number of established suppliers in the optical transport space could have developed the solution. However, both the access and core parts of the network were the more exciting place to invest. While innovation was rapid in these areas, innovation in the optical transport space languished. In fact, the metropolitan transport space was largely ignored in the 1990s with the focus simply on fine-tuning and cost-reducing bit-rate specific product offerings to improve product profit margins[3]. In effect, an optical transport oligarchy emerged, which split the optical transport business in North American metro networks along specific bit rates and configurations[4]. Service providers had no competitive offering from which to serve end-users with a mix of service interfaces nor optimize infrastructure costs with a variety of bit rates and configurations, that is, until Cerent came along with technology innovation and product repackaging.

Multiservice connectivity enabled numerous service interfaces to be aggregated and transported across the optical network, thus facilitating the rise of computer mediated communications. The objectives of this chapter include:

1. Show that integration of multiple functions reduced the physical size and complexity of