



**Copper Mountain & CommWorks
Provide Comprehensive Cost-effective Solutions for
Deploying a Full Spectrum of Value-Added Services Over DSL**

Overview

Over the past few years, the market opportunities for broadband access offerings have undergone sweeping changes in terms of both accelerating demand and expanding scope of services. In the beginning broadband technologies were primarily driven by the need to widen the “last mile” data pipe for improving Internet access and accommodating escalating bandwidth consumption from richer online content. Driven by the ability to deliver high-speed always-on Internet connections over the ubiquitous copper pair wiring already in use throughout the Public Switched Telephone Network (PSTN), Digital Subscriber Line (DSL) technologies have quickly become a leading enabler for the broadband revolution. The inherent ability to leverage the existing telco infrastructure for providing last-mile Internet broadband has catapulted DSL into an unprecedented growth curve, with both incumbent and competitive carriers throughout the world investing heavily in the marketing and deployment of basic data-oriented DSL services. For example, market projections from TeleChoice indicate that the number of DSL lines in service in the U.S. alone will grow from 575,000 in 1999 to 9,569,000 in 2003. According to a study by Cahners In-Stat Group, the worldwide population of DSL subscribers will grow from 4.5 million in 2000 to 74-7 million in 2004.

Even more importantly, forward-looking service providers have already realized that basic high-speed Internet access is only the tip of the iceberg with regard to exploiting the full opportunities for DSL service offerings. As DSL connection methods have widened the last mile to the user, the maturation of DSL technology has also laid the groundwork for uniting upstream IP-based transport environments with efficient delivery of a full of spectrum of new value-added DSL-based broadband services, such as voice, Frame Relay, VPNs, video, etc.

In order to capitalize upon these lucrative multi-service DSL opportunities, carriers and service providers will need to leverage new interoperable end-to-end solutions that can be implemented immediately and grow with changing and evolving market requirements. As will be seen in this brief overview, the combination of complementary solutions from Copper Mountain Networks and CommWorks Corporation provides the entire scope of DSL access, networking and management solutions needed to seamlessly bridge legacy circuit-oriented voice transport and signaling mechanisms within flexible, cost-effective and highly scalable IP networks.

Addressing the Widening Range of Value-added DSL Opportunities

As the communications industry has quickly discovered, DSL is much more than just a “fat pipe” for delivering data over the last mile. With Internet Protocol (IP) having emerged as the de facto transport standard for network infrastructures throughout the world and with service convergence of voice, data and other traffic over shared IP networks, the stage has been set for efficiently bypassing and ultimately phasing out expensive and cumbersome legacy circuit-switched networks. The proliferation and wide acceptance of DSL is helping to make that transition feasible by providing a versatile high-speed connection for delivering IP-based services directly to users. As seen below, DSL allows the seamless extension of the converged-services model from the IP network transport level all the way to the end user.

Voice Over DSL (VoDSL)

VoDSL is rapidly capturing the attention of carriers and service providers because it enables multi-line toll-quality voice connections to be simultaneously carried on the same broadband link with high-speed data traffic. Where only two years ago users viewed DSL primarily as an opportunity to run high-speed data over a “voice” line, now the power of that single DSL connection can be used to support as many as 16 individual phone numbers along with the high-speed flow of Internet data. With integrated Quality of Service (QoS) management capabilities, the DSL link is able to automatically prioritize the voice traffic to maintain consistent toll-quality two-way conversations that are impervious to peaks or bursts in data traffic.

VoDSL represents a major opportunity for CLECs and data service providers because it enables them to quickly offer low-cost multi-line voice connections to business and residential customers, thereby simultaneously driving higher utilization of their network infrastructure investments and tapping into a lucrative new source of revenue. VoDSL is also rapidly becoming a key focus area for ILECs in order to optimize their existing copper loops and stave off competition from cable carriers in the residential markets and CLECs in the business arena. In order to provide competitive VoDSL offerings, all of these carriers will need to leverage new-generation IP-optimized end-to-end solutions that can provide cost-effective transparent management of VoDSL and data traffic.

Virtual Private Networks

DSL also provides an ideal solution for handling Virtual Private Networks (VPNs) between geographically separated locations by leveraging the speed of DSL broadband connections along with the flexibility and reach of the Internet. For instance, a business could quickly and cost-effectively connect multiple satellite offices via DSL-based VPNs for a fraction of the cost for establishing traditional T-1 connections to each office. While VPN technology is already a well proven mechanism for tunneling private connections across the Internet, extending VPNs across DSL requires new-generation traffic-aware end-to-end solutions such as those now provided by CommWorks and Copper Mountain.

Frame Relay Over DSL (FRoDSL)

If required, proven and reliable Frame Relay technologies can also be implemented over DSL links, thereby providing customers with a more cost effective alternative to Frame Relay over traditional dedicated T-1 or partial T-1 circuits. Because of the rapidly widening acceptance and reach of DSL technologies, FRoDSL can also extend the carriers' opportunities for deriving additional revenues from Frame Relay transport services that become more attractive to customers when delivered within the DSL model.

Video Over DSL

The emerging ability to offer Video-over-DSL also opens up a number of attractive new opportunities for service providers. For example, Video-over-DSL has immediate possibilities for deployment into demanding applications such as distance-learning and telemedicine, where universities and hospitals need to be able to flexibly integrate video traffic along with interactive data and voice content. In addition, offering video-on-demand services over DSL can provide new attractive revenue source for ILECs and CLECs while simultaneously fighting back against competitive forays into traditional telephony markets from cable operators.

CommWorks & Copper Mountain: Bringing It All Together

All of these value-added DSL services depend critically upon the availability of a new generation of IP-oriented solutions for deploying and managing DSL offerings, as well as seamlessly merging multi-service environments within overall IP-based network infrastructures. The complementary end-to-end DSL capabilities provided by Copper Mountain and CommWorks comprehensively address these needs for connectivity, interoperability, manageability, and scalability.

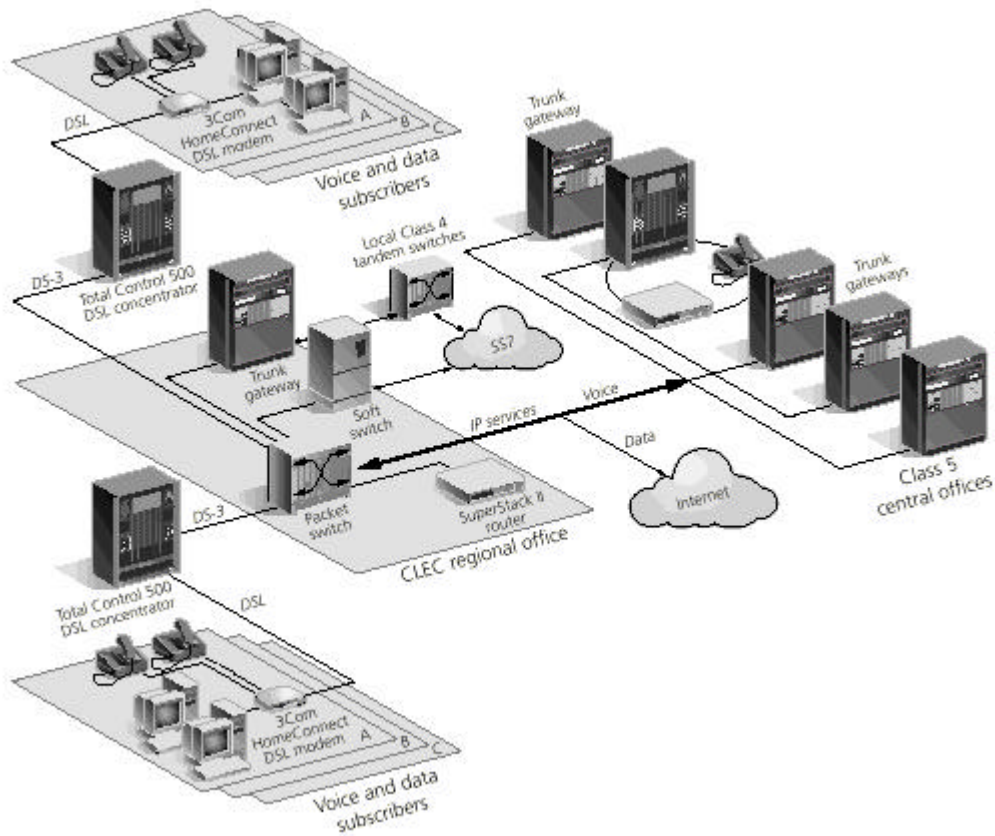
At the heart of the end-to-end solution set is the Total Control 500 DSL Concentrator, which is a direct result of the partnership between CommWorks and Copper Mountain. Unlike previous-generation ATM-based DSLAMs that are rooted in legacy-oriented traditional circuit-switched telephony environments, Total Control 500 DSL Concentrator platforms are able to automatically differentiate and handle voice, IP packets, VPN traffic, etc. In addition, with integrated QoS management capabilities, the Total Control system can ensure that every traffic type receives appropriate prioritization and maintains consistent quality levels.

Copper Mountain's IP IQ™ technology dynamically recognizes user profiles and services at the IP layer and automatically allocates network resources as required, thereby maximizing overall bandwidth utilization throughout the network and enabling smooth scalability of network resources. In addition, Copper Mountain's network management software tools provide full flexibility for remotely managing all aspects of the DSL service provisioning, monitoring and optimization.

IP IQ and Total Control combine to provide a comprehensive "Service Intelligent Architecture" with the inherent performance and flexibility to quickly and dynamically

provision the full spectrum of value-added DSL services across a common infrastructure, thus enhancing both responsiveness to market requirements and the optimized utilization of their equipment investments.

By leveraging Copper Mountain's Service Intelligent DSL architecture in conjunction with CommWorks' comprehensive Total Control 3-tiered architecture, carriers and service providers can create and deploy a full range of value-added applications to augment and enhance DSL offerings and seamlessly integrate with both legacy telephony and new IP environments. The CommWorks architecture extends from Tier 3 service and applications creation environments, through Tier 2 signaling and control capabilities as well as providing universal connectivity for Tier 3 media processing. Whether the specific requirements are to transport IP packets directly into the Internet backbone, to dynamically manage VPNs or to provide voice connections with full SS7 signaling and PSTN connectivity, the CommWorks – Copper Mountain solutions provide the answers.



The bottom line for carriers, service providers and end customers alike, is that the partnership between Copper Mountain and CommWorks provides a comprehensive solution for immediately leveraging the maximum value from today's DSL technologies while simultaneously laying an extensible groundwork for ongoing scalability and extensibility.