Multi**DSL**

Profit Opportunities for Network Service Providers

Ascend MultiDSL Profit Potential

Monthly Cost			Monthly Revenue

$600

$500

$400

$300 **PROFIT RANGE**

$200

$100 **PROFIT RANGE** **COST**

COST

IDSL   IDSL, SDSL, ADSL
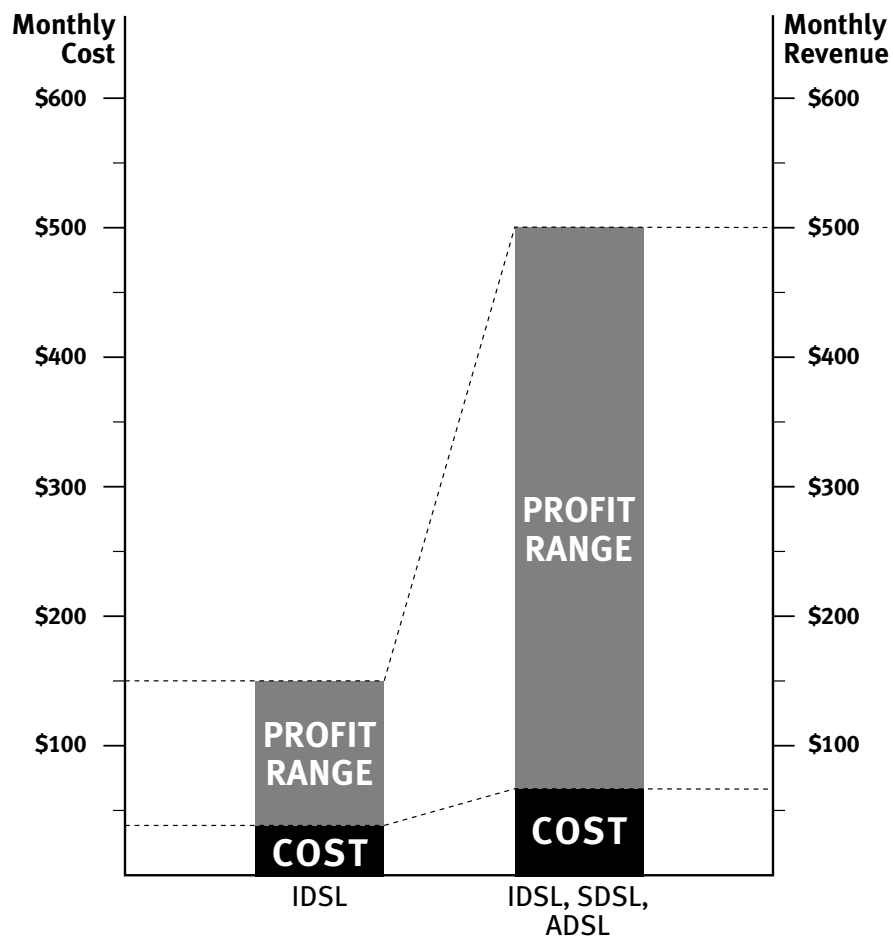
Ascend's MultiDSL™ is the only fully-integrated, turnkey DSL solution that includes both the Central Office Equipment (COE) and the Customer Premises Equipment (CPE) required for high-speed DSL services. This guide details the applications, requirements, and cost/revenue issues for CAPs, LECs and ISPs to immediately profit in the DSL market.

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Executive Summary

- Digital Subscriber Line (DSL) is a new, enabling high-bandwidth technology that provides big opportunities for business customers and Network Service Providers (NSPs) alike.

- The demand in this untapped market will explode over the next few years.

- DSL also facilitates a new architecture that helps remedy congestion in both the Public Switched Telephone Network (PSTN) and the Internet.

- Ascend's MultiDSL™ product line is the industry's first complete DSL solution.

- MultiDSL encompasses both Point of Presence (POP) equipment and compatible Customer Premises Equipment (CPE).

- Ascend's MultiDSL is 18-24 months ahead of any other single vendor's offering.

- MultiDSL gives NSPs:

    - 75-90% profit margins

    - Minimal up-front investment

    - Incremental expansion potential for profitable growth

- NSPs early to market will reap the largest rewards

Introduction

With the Internet becoming strategic for businesses, Network Service Providers (NSPs) have an opportunity to become more strategic for their business customers. Industry analysts predict worldwide Internet service revenue will reach $41 billion in 1999–$20 billion in the U.S. alone. Most of this growth involves business use, bringing about a profitable change from the traditional Internet account: the individual subscriber. Most of that growth requires high-speed digital access, such as that provided by Digital Subscriber Line (DSL) technology.

DSL is a powerful technology with three compelling advantages:

- Meets the rapidly growing bandwidth and changing application needs of both business and consumer customers

- Leverages the existing local loop infrastructure to lower implementation costs

- Helps remedy Public Switched Telephone Network congestion (PSTN)

DSL offers unprecedented local loop performance, ranging from 128 Kbps to 6 Mbps, with continuous or "always on" access. DSL's price/performance is expected to result in the installation of nearly 8 million lines over the next four years, according to Dataquest.
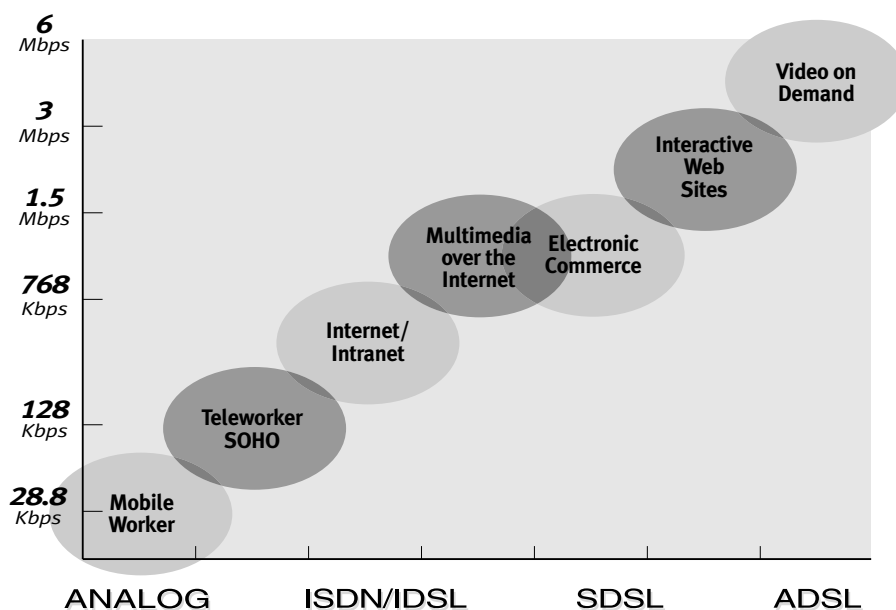
Figure 1 – DSL offers users a choice of bandwidth to satisfy a wide range of Internet access and other remote networking needs.

Digital Subscriber Line versions

- *ISDN Digital Subscriber Line (IDSL), invented by Ascend, delivers 128 Kbps performance and offers compatibility with existing ISDN access equipment.*

- *Symmetric Digital Subscriber Line (SDSL) furnishes 768 Kbps symmetric throughput for a capable and cost-effective alternative to leased lines.*

- *Asymmetric Digital Subscriber Line (ADSL) integrates lifeline voice with high-speed video and data for a total communications solution on a single pair of wiring. ADSL is available in Carrierless Amplitude Phase (CAP) and Discrete Multi-Tone (DMT) options that provide 64-640 Kbps in the upstream direction (from the subscriber) and 1.54-6.14 Mbps in the downstream direction, where bandwidth is needed the most.*

Meeting the increasingly sophisticated and demanding needs of a new breed of Internet "power" users, particularly of business customers, requires more than mere bandwidth. Individually, the Incumbent Local Exchange Carrier (ILEC), the Competitive Access Provider (CAP) and the Internet Service Provider (ISP) may not be able to meet all of a business customer's Internet access needs. Cooperating in partnerships, however, these and other NSPs will find more successful and profitable opportunities. Such partnerships allow each party to maintain its core competency while entering new markets, and the collective strengths of all parties combine to produce an attractive and highly profitable customer offering. And here too, DSL helps facilitate these partnerships by enabling the very infrastructure that offers something better for everyone – NSPs and users alike.

To allow all NSPs to take full advantage of the changing Internet market opportunity, Ascend Communications, the leader in Internet access, offers MultiDSL, the industry's first complete DSL solution. The MultiDSL product line is designed to meet the changing needs of both users and NSPs. MultiDSL encompasses a full range of Customer Premises Equipment (CPE) for corporate and individual access, along with the proven and scalable family of MAX™ WAN access switches for the Points of Presence (POPs). Both the CPE and Central Office Equipment (COE) such as POP equipment support today's full spectrum of DSL technology including IDSL, SDSL and ADSL-CAP/DMT.

MultiDSL is part of a total remote networking solution from Ascend that offers NSPs two major benefits:

- Increased profits from a combination of lower costs and higher revenues
- A new and more enduring POP architecture that helps remedy PSTN and Internet congestion.
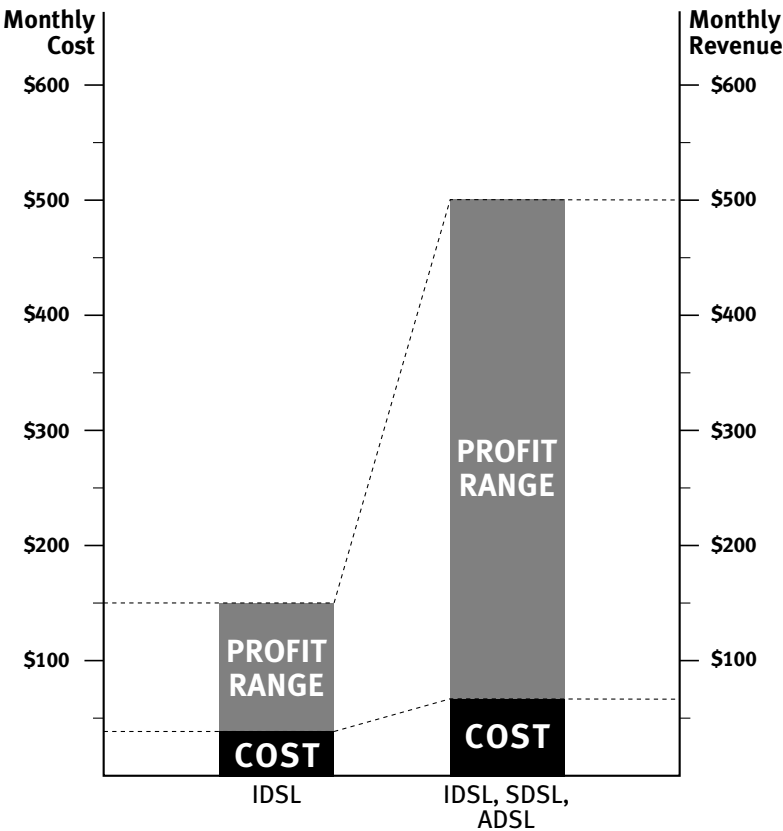
Ascend MultiDSL Profit Potential

Figure 2 – MultiDSL profits vary widely based on the number of revenue generating services that are bundled.

DSL Market Overview and Trends

Because the popularity of the Internet is providing most of the critical mass needed for revolutionary change, this chapter presents an Internet-centric view of the DSL market. But the Internet is just the tip of the DSL iceberg. The next chapter on applications reveals a wealth of other high-growth markets not reflected in these forecasts. The overall market is just too new, the opportunity too great, to accurately predict at this time.

Driving Forces

The forces that will drive and guide the imminent remote networking revolution include:

- An insatiable appetite for bandwidth, brought about primarily by today's more sophisticated Internet applications, is motivating users to seek NSPs who can meet their performance needs.
- The relentless bandwidth demand by the growing number of on-line users has created an urgent need to alleviate congestion in both the PSTN and the Internet backbone.
- The Telecommunications Act of 1996, which in part mandates cooperation by deregulating the local loop, is providing a catalyst for action in the delivery of both voice and data communications services.
- Technology advances that include carrier-class access equipment, fast IP switching, tunneling for Internet-based Virtual Private Networks (VPNs) – in addition to DSL itself – are serving as cost-effective enablers.
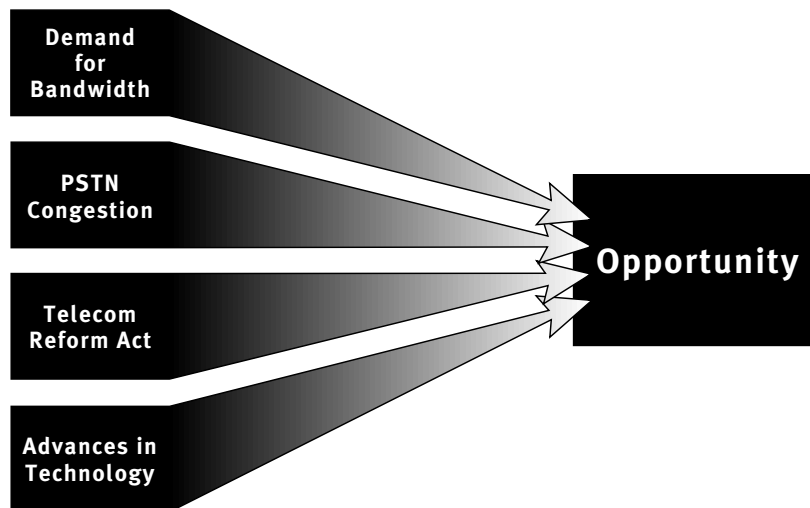

Figure 3 – These four driving forces will change the Internet market forever – and for the better.

Market Forecast

The Internet is becoming a strategic communications vehicle for most organizations around the world. Many now use the World Wide Web as the primary means for reaching prospective customers and supporting existing ones. Employees have become dependent on e–mail for communications and on the Web for conducting research. Internet-based VPNs are extending local intranets enterprise-wide, and worldwide.

As the Internet becomes a vital element of daily business operations, NSPs become indispensable to businesses. Many organizations already outsource their Web server needs, and more are turning to NSPs for end-user support, VPNs, customer premises equipment, consulting and other value-added services. As a result, worldwide Internet service revenue is forecasted to grow from $1 billion in 1995 to an astounding $41 billion in 1999, according to Zona Research. The following charts depict similar growth trends in related areas.
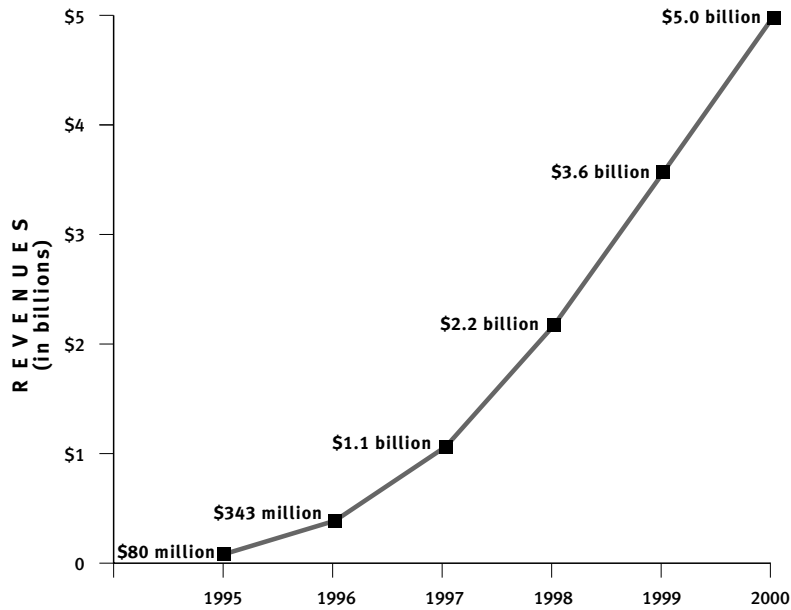
U.S. Internet Services Revenue Growth
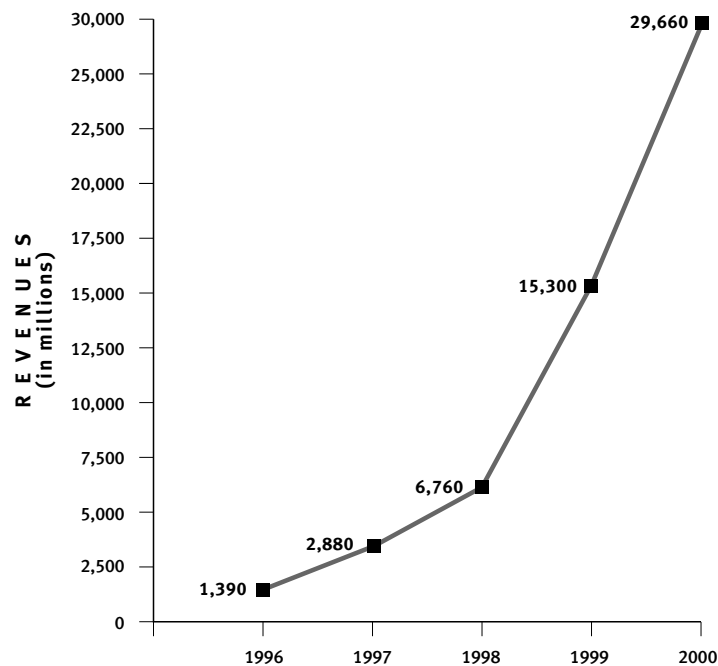
Source: Forrester Research Inc. (Cambridge, Mass.)

Figure 4 – In the U.S. alone, Internet service revenues will approach $20 billion by the turn of the millennium.
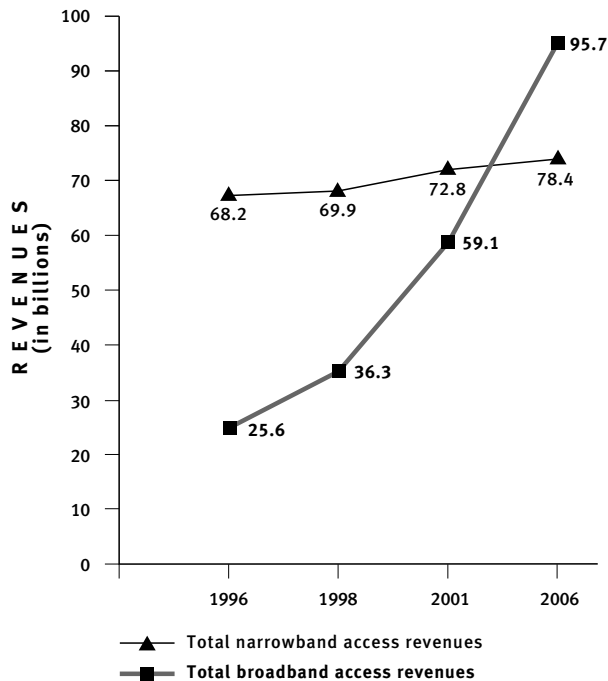
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Projected Revenues for Content Providers

Source: Jupiter Communications, 1996, Online Advertising Report

Figure 5 – Internet advertising will be a $5 billion business in the year 2000.
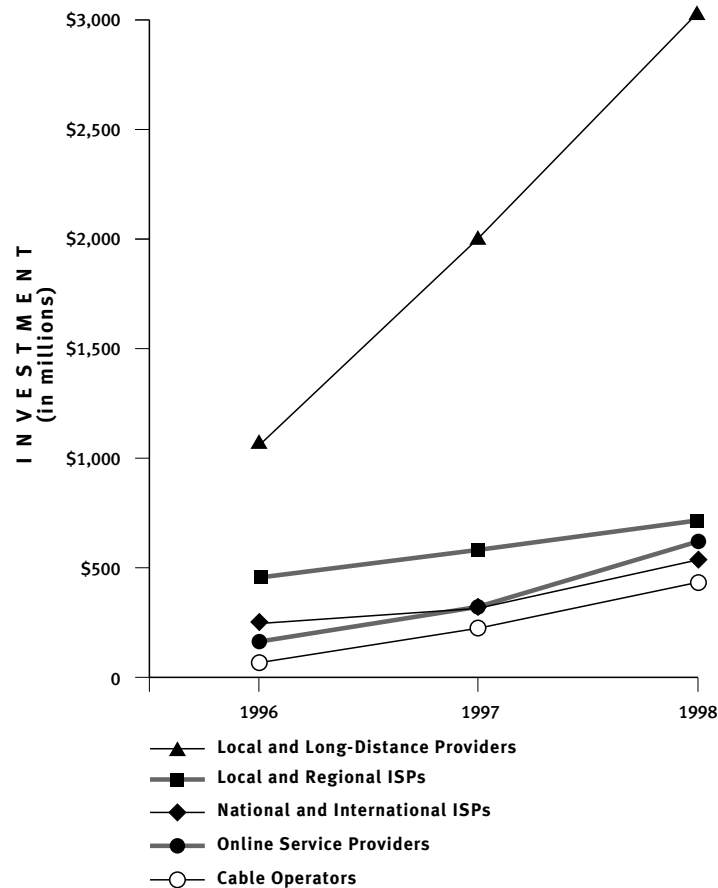
U.S. Local Access Line Revenues

Source: Lawrence Gasman, Communications Industry Researchers Inc. (Charlottesville, Va.)

Figure 6 – Broadband access revenues, from technologies like DSL, will surpass narrowband access revenues within 10 years.

Worldwide Spending on Internet-Related Technology

Figure 7 – All network service providers are gearing up to meet the growing demand.

The need for speed will drive a growing number of individual and business subscribers toward high-speed digital services. An increased dependence on the Internet will drive many of these same users toward continuous, always on-line access. Both of these needs are met with DSL technology. Dataquest forecasts there will be nearly 8 million DSL lines in use worldwide by 2000. Figure 8 depicts projected DSL demand in the U.S.

Projected U.S. DSL Market (In Lines)
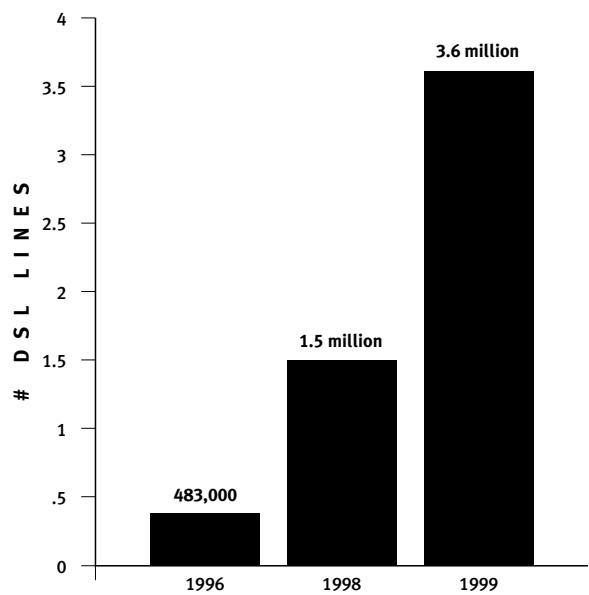
Source: TeleChoice Inc.

Figure 8 – DSL's high speed and continuous service will make it a popular access technology.

Twenty DSL Applications

Success in the Internet access market today requires meeting customers' evolving needs, while leveraging existing infrastructure to keep deployment costs to a minimum. Use of the Internet for mission-critical business applications will also call for welcomed infrastructure enhancements to remedy PSTN and Internet backbone congestion, along with implementation of quality of service options and security provisions. DSL paves the way for handling all of these impending changes – in a profitable manner. This chapter presents an overview of business customer requirements, followed by a list of 20 Internet and other applications for DSL.

Meeting the Total Needs of the Business Customer

The overall needs of business customers are becoming more sophisticated – and more demanding. DSL helps satisfy many of these general requirements:

- The need for speed from more users with more dependency on the Internet, running more sophisticated applications
- Choice of dial-up and continuous on-line access
- Immediate availability of new technologies and applications, such as IP-based faxing and voice services
- Multimedia capabilities for promoting products and services, as well as for on-demand video, videoconferencing and distance learning
- Virtual Private Networks (VPNs) for telecommuters, mobile workers and remote offices
- Network management and "help desk" support assistance with superior response and better results that in-house MIS staff can cost-effectively deliver
- One-stop shopping for turnkey Internet access, value-added services and customer premises equipment
- The option to use existing equipment to minimize further investment
- Bundled offerings with centralized invoicing to simplify accounting
- Web hosting for small businesses

The Twenty Applications

Here is a list of just 20 of the many applications for DSL technology, each with a brief description. The list is in two parts: those based on the Internet, and general applications. Note that the general applications, which offer significant revenue opportunities, were not included in the market forecasts presented in the previous chapter.

Internet Applications

1. *Upgrade Analog Modem Users* – IDSL is an attractive alternative to ISDN for current analog modem users needing easy-to-use, high-speed Internet access for extended periods of time.
2. *Integrate Voice Communications and Internet Access* – ADSL provides a voice/data solution on a single twisted pair of wiring. The single line is split at both the central office and customer's site to separate the lifeline voice and high-speed data channels.

3. *Affordable Continuous Internet Access* – When an existing ISDN line remains up for most of the day, the customer is likely paying too much for access, while precious resources are being consumed in the PSTN. IDSL offers a much better solution.

4. *Replace Leased Lines* – IDSL and SDSL are cost-effective alternatives for leased lines used for Internet access. The new configuration can be a win/win arrangement for both the customer and the NSP.

5. *Web Hosting* – Many organizations prefer not to outsource their Web needs, and IDSL or SDSL delivers the performance and continuous on-line access they need.

6. *Collaborative Work* – Whether the participants are in the same organization or from separate parties, high-performance shared whiteboard and other Internet-based workgroup applications can substantially improve teamwork and productivity.

7. *Distance Learning* – IP multicast is a great way to "broadcast" audio and video to students taking a class or "attendees" of a conference. Depending on the quality of service desired, either IDSL or SDSL will meet the need.

8. *IP Multicast* – Leverage the Internet's worldwide presence and multicast capability for other audio/video applications. Most corporations regularly hold company meetings for employees, customers or investors, and DSL provides a cost-effective alternative to satellite or other means of broadcasting these events.

9. *Virtual Private Networks or Intranets* – DSL's "nailed up" connections help provide the desired security; its high throughput offers performance levels similar to those of a private network. Together, these capabilities make DSL ideal for VPNs.

10. *Inter-company VPNs or Extranets* – Why limit VPNs to internal use only? Internet-based extranets allow customers, suppliers and business partners to work together productively and cost-effectively.

11. *Internet Commerce* – On-line multimedia catalogs require high performance for satisfactory results. SDSL can handle the Web server catalog and "order desk"; IDSL is perfect for a consumer kiosk located in a mall, shopping center or anywhere.

General Applications

12. *WAN Services Upgrades* – Just as with Internet access, DSL is often a capable and affordable alternative to analog modems, ISDN or leased lines used in private networks.

13. *Metropolitan Area Data Network* – A company with facilities throughout a city would likely find DSL an attractive networking solution. A fiber optic MAN could provide the data backbone between central offices, if needed.

14. *Videoconferencing* – DSL can handle videoconferencing needs just as well, if not better, than traditional PSTN solutions. A single SDSL link has a throughput equivalent to six ISDN BRI lines, and eliminates the need for an inverse multiplexer.

15. *Medical Imaging* – DSL can extend medical imaging's reach to permit collaboration among specialists at widespread medical facilities. In life and death situations, nothing less than peak performance is acceptable.

16. *Vertical Industry Applications* – Search the local market for other vertical applications by industry in CAD/CAM, retail, financial, government, schools and libraries. Look for specialized applications in each industry that require high performance and constant access — the twin strengths of DSL.

17. *SOHO Solution* – DSL affords telecommuters in the small office/home office (SOHO) environment a better alternative than analog modems or ISDN. Use IDSL for data-only needs, and ADSL as an integrated voice/data solution.

18. *Video-On-Demand* – ADSL competes with the local cable company by offering on-demand home video. At 6 Mbps downstream, ADSL delivers superb quality for video-on-demand applications.

19. *Security Monitoring* – Why not partner with a local security company, for example, to create a remote site security infrastructure. An IDSL link can handle around-the-clock video or alarm monitoring at any building in the service area.

20. *Private DSL* – DSL has applications outside of the central office, especially as a private networking solution in a campus or high-rise office building. This is just a sampling of how DSL can help meet the needs of increasingly sophisticated users with more demanding applications in an increasingly competitive marketplace. Indeed, DSL's uses may be limited only by the imagination.
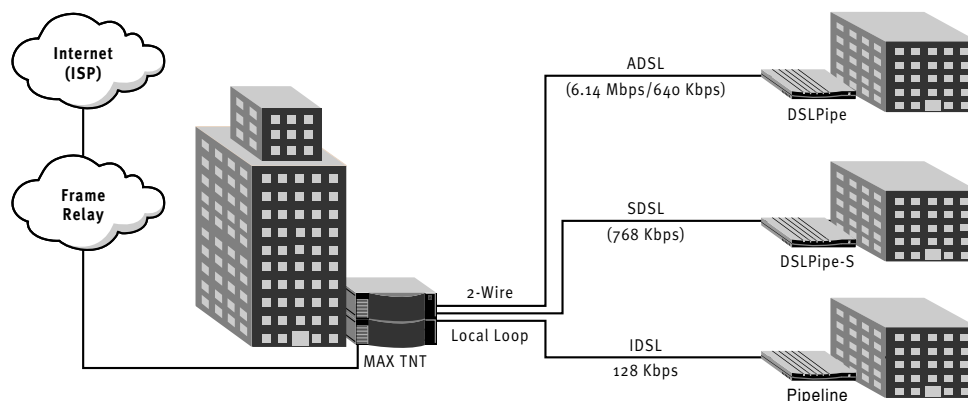
Figure 9 – DSL is also a great solution for "private local loop" voice/video/data applications.

DSL in a Campus or High-rise Office Building Network

A unique and potentially profitable market opportunity provided by DSL exists at sites with substantial "private local loops." These facilities have cable plants similar to those of a central office, albeit on a smaller scale. NSPs can apply the learning experience with multi-service local loops and POPs to implement a capable and cost-effective private voice/video/data communications infrastructure. Once in place, the "Private POP" CPE, makes a high-speed DSL or WAN connection to the NSP's POP for data and video communications, and to a PBX or the PSTN for voice and videoconferencing traffic.

Any large facility is a viable prospect:

- *High-rise office buildings*
- *Large apartments or housing complexes*
- *Universities*
- *Hospitals*
- *Federal, state and local government sites*
- *Military bases*
- *Corporate headquarters*

DSL also provides a way to compete with data-only LAN hub solutions.

For example, a single pair of wiring with ADSL delivers both lifeline voice and high-speed data to a desktop or room.

DSL Buildout Alternatives

The Internet access market today is characterized by a constant need to grow capacity in the face of declining rates. NSPs want to change this unprofitable scenario in both halves of the ROI equation with a premium service that commands a premium rate, along with a more efficient and cost-effective network architecture. DSL helps achieve both halves of the NSP objective by facilitating a more enduring and profitable central office or point of presence architecture.

When migrating from the old world of using the PSTN for all voice and data communication to the new split voice/data architecture, there are several issues to consider:

- Multiple solutions for both traditional PSTN access (analog modems, ISDN, etc.) and DSL access complicates the installation and support tasks

- Separate solutions for each DSL offering at the POP – potentially from different vendors – can increase implementation and operating costs

- Security and performance are compromised by the shared LAN or other interconnections among the various subscriber-side solutions

- Managing the new POP architecture can be more demanding because it handles a much greater volume of traffic, potentially from many more users

- Interoperability of POP equipment with customer premises equipment cannot be taken for granted with new technologies like SDSL and ADSL-CAP/DMT

By increasing the level of integration at the POP, NSPs can minimize problems and maximize economies of scale. For example, separate remote access concentrators–one for analog modem access, another for ISDN, yet another for ADSL and so on–requires duplication of common elements, consumes more rack space and involves complicated interconnections.

A single, fully-integrated WAN access switch provides a far more cost-effective short- and long-term solution. Consider a simple upgrade situation: As time goes by and DSL becomes more widely used, the need to support ISDN and analog modem users will diminish. A fully integrated WAN access switch can be reconfigured to support the new access mix. This cost-savings flexibility is lost with separate access solutions.
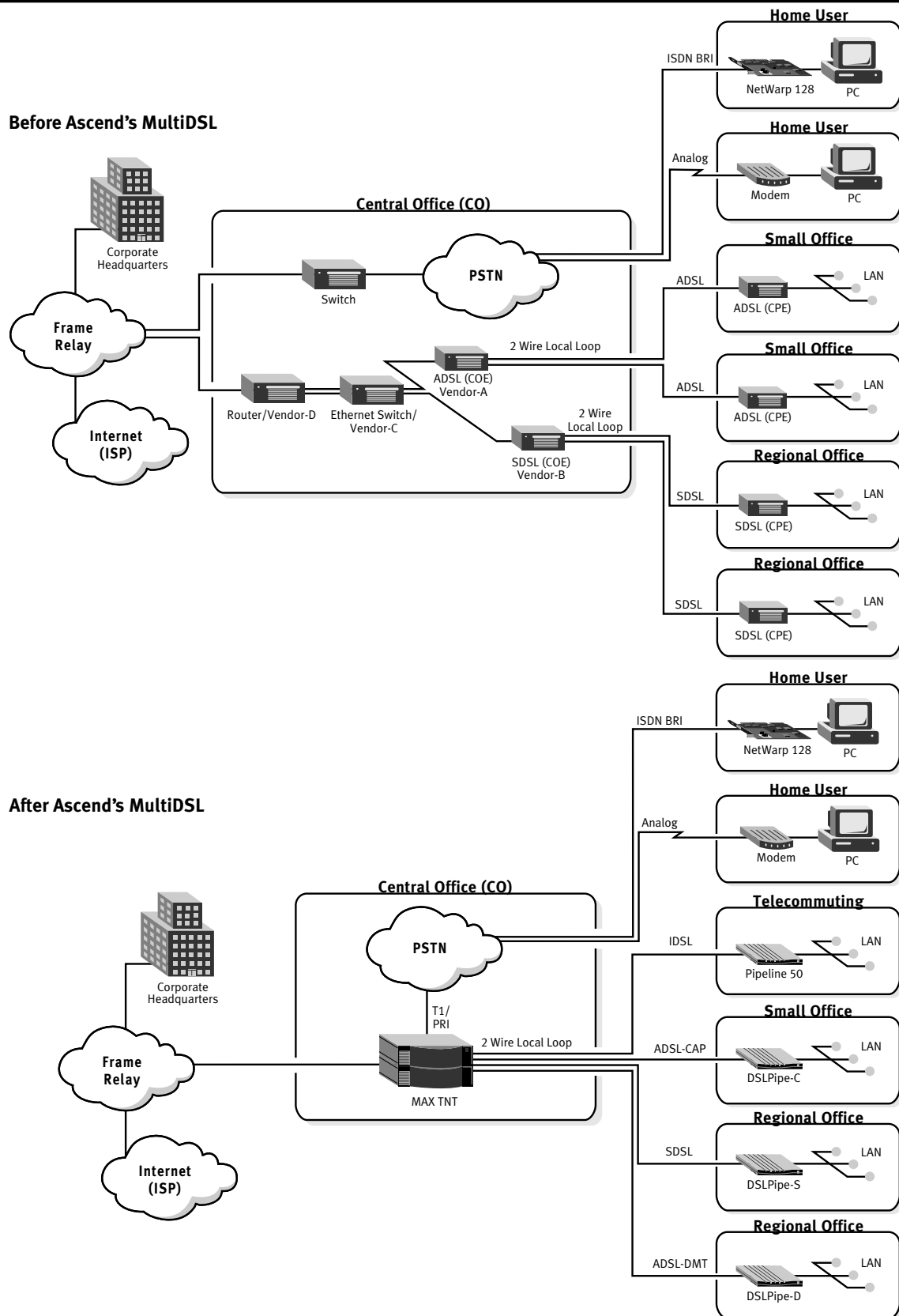
Before Ascend's MultiDSL

After Ascend's MultiDSL

Figure 10 – Ascend MultiDSL is a unique solution that is easy to migrate to and scalable for all DSL alternatives.

Ascend's MultiDSL Solution

Ascend Communications offers solutions for all three building blocks needed to support DSL.

- WAN access
- CPE
- Network Management

The MultiDSL approach gives users the bandwidth they crave, and it provides NSPs a way to implement the offering profitably.
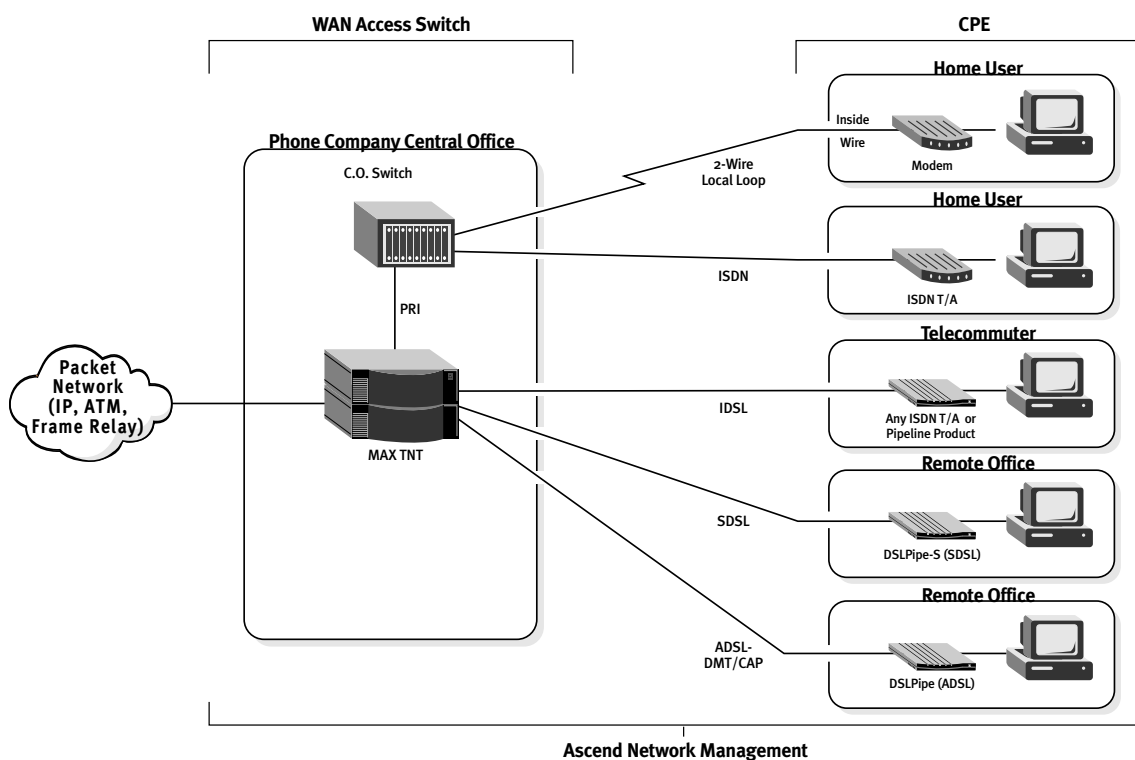

Figure 11 – Ascend MultiDSL Solution

MAX TNT WAN Access Switch

The MAX TNT™ is a member of Ascend's proven and scalable family of WAN access switches. A single MAX TNT can handle up to 672 concurrent sessions, making it the only carrier-class WAN access switch available. The MAX TNT supports the full spectrum of DSL technology, including IDSL, SDSL and ADSL-CAP/DMT, along with all conventional WAN access services. The integration of DSL with WAN and LAN connectivity in a common MAX TNT platform is what allows NSPs to implement DSL incrementally and profitably.

The MAX Dominates Internet Access Worldwide

Ascend's MAX WAN access switches are used by the vast majority of leading ISPs around the globe. In total, over 1,000 ISPs have installed the MAX in over 6,000 points of presence. There are over 2,000,000 MAX Internet ports handling some 15 to 20 million Internet sessions each and every day. No other solution is more capable – and more proven – for Internet access.

The MAX TNT replaces multiple pieces of equipment including analog modem banks, ISDN terminal adapters, remote access servers, terminal servers, routers and stand-alone firewall systems. The integrated approach makes the MAX easier to install, operate, manage and upgrade – which is why it is so popular with NSPs worldwide. In addition to meeting all of the minimum WAN access switch requirements outlined in the previous chapter, the MAX TNT offers these advanced features:

- 16 card slots that can be populated with any mix of WAN options that include IDSL, SDSL, ADSL CAP/DMT, digital modems, ISDN BRI/PRI, T1, fractional T1, SW56, Frame Relay and T3
- High-speed PSTN trunks consolidate channels from both digital modems (analog access) and ISDN BRI and SW56 (digital access) to optimize availability and resource utilization
- Up to three MAX TNT shelves can be managed as a single unit to handle up to 4,032 ISDN or Frame Relay sessions, 2,016 analog modem sessions or 720 (on 3-shelves) DSL links concurrently
- A choice of Ethernet, Fast Ethernet or FDDI to attach local servers and interface to an IP switch for the Internet backhaul/backbone connection
- Built-in compression to maximize throughput
- Dynamic bandwidth management for enhanced performance
- Robust support for features needed to implement customer VPNs, including encryption and authentication security, Generic Routing Encapsulation and Point-to-Point Tunneling Protocols, and "IP Direct" and "Frame Relay Direct" to redirect tunneling within the NSP's POP network rather than onto the Internet backbone
- Support for Internet Group Management Protocol (IGMP) for IP multicast
- Reliable hardware and robust redundancy features yield high system availability
- Fully certified with popular switches and WAN services for operation around the world

The modular architecture and advanced feature set combine to make the MAX TNT a strategic point of presence platform for the future that NSPs can afford today.

Ascend DSLPipe, Pipeline and NetWarp CPE

Ascend offers a complete line of CPE for individual users, SOHO environments and even large sites with dozens to several hundred employees. Such a broad, compatible product line is particularly suited to NSPs directly supporting or reselling CPE.

Ascend's CPE includes all current ISDN models of the popular Pipeline® family for IDSL access, along with DSLPipe™ products which leverage Pipeline technology to support SDSL and ADSL-CAP/DMT. Its powerful capabilities and competitive price have made Pipeline the market leader and earned the family more awards than any other remote access solution in the industry. In addition to supporting all of the minimum CPE requirements outlined in the previous chapter, the Pipeline family offers several attractive advanced features:

- Built-in, standards-based 4:1 compression for maximum throughput
- Tamper-proof security robust enough for virtual private networks
- Usage reporting to support the customer's own accounting needs
- Simplicity of installation, configuration, operation and management
- An optional integral dynamic firewall available on all multi-user models
- The Pipeline 130 has a built-in WAN interface, in addition to the IDSL connection, for a separate Frame Relay or leased line application

Because IDSL is compatible with ISDN, NSPs can select from Ascend's full range of ISDN remote access solutions. As an alternative to stand-alone Ethernet-based remote access routers, like the Pipeline systems, Ascend also offers a family of NetWarp™ products, which are terminal adapters for PCs or shared servers. Positioned as high-performance, low-cost ISDN devices, the Netwarp 128 and Netwarp Pro fit large-scale networking needs involving several hundreds or thousands of users and sites. Because both NetWarp and Pipeline products avoid the traditional COMport bottleneck common in other ISDN solutions, they provide the maximum throughput of 512 kbps (with built-in 4:1 compression) offered by IDSL.

Ascend's DSLPipe products are based on the popular and award-winning Pipeline remote access routers. Three models are available: the DSLPipe-S for SDSL; the DSLPipe-C for ADSL-CAP; and the DSLPipe-D for ADSL-DMT. With compression the DSLPipe-S provides an astonishing 768 Kbps of throughput – enough to support an office with several hundred average users and a Web server. The ADSL models are ideal for individual users and may also be deployed in office environments with limited *outbound* traffic (that is, very few *remote* users who need regular access to servers at the site).

Ascend Management Offering

MultiDSL Benefits for Businesses and Individual Users

- *Offers a choice of data rates to meet the full range of price/performance requirements*

- *Eliminates the need to rewire or pull fiber optic cabling to achieve higher data rates*

- *Improves productivity from continuous access and increased throughput*

- *Enhances ability to plan budgets by allowing fixed monthly rates*

- *Protects investment by leveraging existing ISDN CPE with IDSL*

- *Delivers a turnkey solution when combined with value-added services*

All Ascend equipment – both at the point of presence and on the customer's premises – is fully manageable using industry standards. Ascend also offers a wide range of diagnostic and capacity planning tools, in addition to robust RADIUS support. Ascend's overall network management capabilities include:

- Local equipment management to handle installation/configuration and assist with on-site troubleshooting

- Full remote management for supporting CPE at subscriber sites and "lights out" operation of distant POPs

- An intuitive Graphical User Interface (GUI) to minimize training needs and maximize support staff productivity

- Auto-discovery and mapping of the entire network topology

- An ability to set alarm thresholds for a wide range of conditions

- Traffic monitoring in real-time for trouble-shooting and assessing performance, as well as historically for base-lining and capacity planning

- Traffic statistics are available by protocol and include packets forwarded, packets dropped, mean packet size, interface/channel utilization, buffer/queue lengths, and more

- A path-finder utility to trace traffic end-to-end through the network

- An ability to compare actual equipment configurations with intended configurations stored in the data base

- A scheduler for coordinating and automating network-wide upgrades

- Security to prevent unauthorized use of all management applications

- Support for all standard RADIUS features plus over 100 enhancements, including a Java-based point-and-click user interface

- The RADIUS enhancements, combined with call detail reporting from MAX WAN access switches, give an NSP all the tools necessary to administer subscriber accounts, generate invoices and provide adequate security for Internet-based VPNs

Ascend MultiDSL Benefits

The MultiDSL solution affords two major benefits to NSPs. The first is a new and enduring architecture that creates parallel voice and data infrastructures. Separating voice and data traffic at the local loop connection with MultiDSL preserves the PSTN for voice. The resulting parallel data-only backbone can take advantage of IP switching for dramatically improved throughput.

The second benefit is the increased profit potential generated by a combination of lower costs and higher revenues. NSPs can implement MultiDSL incrementally in profitable steps and, by offloading all that data traffic, can postpone or eliminate expensive upgrades to the PSTN. And because DSL provides a premium service (continuous access with dependable high-speed digital throughput) it can command a premium, flat-rate price. Finally, MultiDSL presents a profitable opportunity to migrate customers from analog modems and ISDN BRI.

Financial Analysis

The table below summarizes monthly per-line costs, revenue and margins for providing Internet access to offices with DSL in three separate scenarios:

- **IDSL** with 128 Kbps performance for 10-user office (CPE is owned)
- **IDSL** with 128 Kbps performance for 10-user office (CPE is supplied)
- **SDSL** with 768 Kbps performance for 50-user offices (CPE is supplied)

Each technology can support more users, of course, but these service points were chosen to produce a conservative analysis.

The costs encompass *subscriber side* communications expenditures only to focus exclusively on the profitability of DSL as a service offering. Costs related to the Internet backhaul connection and to Internet-specific services are omitted because these are applicable to providing basic Internet access services independent of the WAN technologies used. Similarly, the analysis excludes any cost savings associated with PSTN upgrades that can be delayed or eliminated based on the parallel voice/data infrastructure enabled by DSL.

Your local loop and rack space lease costs may vary substantially, and your local market may call for different subscriber rates. But the format provided can serve as both a starting point and a framework for conducting your own financial analysis.

Per-Line Financial Analysis	IDSL CPE Owned	IDSL CPE Supplied	SDSL CPE Supplied
Point of Presence Equipment (1)	$19	$19	$25
Customer Premises Equipment (1)	0	32	53
Local Loop Line Lease (2)	12	12	12
Rack Space Lease (3)	8	8	8
TOTAL Monthly Cost	$39	$71	$98
Monthly Subscriber Revenue (4)	$50-150	$100-200	$150-500
Monthly Margin (Per Line)	**$10-110**	**$25-125**	**$50-400**

See Appendix for details

NOTES:

1. POP and CPE configuration details can be found in the Appendix. All equipment includes monthly support charges. The local network connection for the MAX TNT (built-in 10 Mbps Ethernet, 100 Mbps Fast Ethernet or 45 Mbps HSSI) approximates one half of the aggregate subscriber bandwidth.

2. An "average" rate of $12/month is used for the local loop lease, as charging substantially more than this would appear to violate provisions of the Telecommunications Act.

3. A calculated rate of $8/month was used for the rack space lease based on typical rates and MAX TNT port densities.

4. Estimates on subscriber revenues vary widely based on the number of services offered over the high-speed dedicated connection. NSPs are intending to bundle many services beyond current dial-tone and data service offerings, examples include: Internet access, web hosting, audio delivery and multicast, video multicast and distance learning, bundled telecommuting, virtual private networking, 24-hour network management and monitoring, and a wide range of shopping/electronic commerce services. The cumulative revenues for these services will also vary between residential, home office, small office and branch office support packages. Example ranges for business subscribers monthly revenues are:
   - IDSL – from $50 to $150
   - SDSL – from $150 to $500

NSP Opportunities

The DSL market opportunity is available to all network service providers: Incumbent Local Exchange Carriers (ILECs), competitive access providers (CAPs evolving into competitive LECs or CLECs) and Internet service providers (ISPs). Each has a key role to play and, together in strategic partnerships, all stand to gain considerably from the introduction of DSL technology into the marketplace.

Cooperation mandated by the *voice-oriented* Telecommunications Act of 1996 was not intended to create an environment of competitor-crushing exploitation. NSPs are, therefore, better served by treating the act as a catalyst, rather than as a competitive threat or weapon, especially when it comes to *data* communications services like Internet access.

Such cooperation is often more profitable than competition, because it affords each participant a healthy piece of a much bigger pie. Partnerships allow the parties to maintain core competencies while entering new markets. And the collective strengths of all parties combine to produce a potentially irresistible customer offering. Turnkey is the key: a solution that combines CPE, network access, Internet backhaul, end-user support and other value-added services is attractive to customers and achieves economies of scale for each NSP. Everybody is better off in this win/win scenario.

Incumbent local exchange carriers, competitive access providers, Internet service providers and other network service providers all have strengths to bring and opportunities to gain from strategic partnerships.

Incumbent local exchange carriers (ILECs) offer these strengths:

- The local loop–much of it underutilized and, therefore, not now contributing to profits
- Central office facilities and staff
- Sophisticated billing services
- Marketing and sales reach to a large – and loyal – subscriber base
- Strong name recognition

LECs stand to gain from cooperation with an opportunity to:

- Relieve congestion in the PSTN
- Offer competitively priced high-speed data services
- Resell CPE to end users
- Lease unused pairs in the local loop
- Implement co-location arrangements
- Provide wholesale transport to ISPs
- Become an ISP for the subscriber base
- Compete against cable companies and on-line services

A Great Way to Get Started with MultiDSL

Offering IDSL and SDSL access initially is a cost-effective way for NSPs to "own the pair" and establish the next-generation split voice/data POP architecture. IDSL is compatible with existing ISDN CPE, and both IDSL and SDSL are compatible with "U" repeaters and Digital Loop Carrier (DLC) systems, making these the most attractive and simplest DSL technologies to implement. And, the solution is both similar to and competitive against the increasingly popular Frame Relay. With the new architecture in place, the NSP partners can expand the IDSL/SDSL configuration and add ADSL as demand grows.

Competitive access providers (CAPs, including competitive LECs and, potentially, power utilities) offer these strengths:

- High-capacity fiber infrastructure
- Metropolitan area networks connecting office buildings
- A growing customer base of private network prospects

CAPs stand to gain from cooperation with an opportunity to:

- Penetrate local neighborhoods
- Offer high-speed competitive services
- Furnish wholesale transport to ISPs
- Offer Internet access now, VPNs and multimedia later
- Serve as a network integrator for campus applications

Internet service providers (ISPs) offer these strengths:

- Data networking expertise with MAX WAN access switches, RADIUS management, local area networks and Internet backhaul
- Internet technology proficiency with IP routing, DNS, security options and VPN tunneling
- Internet application skills, particularly with Web servers/browsers and e-mail
- Outsourcing experience with Web hosting and "help desks"
- Customer base of "veteran" Internet users

ISPs stand to gain from cooperation with an opportunity to:

- Differentiate services from direct competition
- Increase margins with more revenue from high-speed access
- Minimize turnover by establishing long-term contracts with business clients
- Obtain wholesale transport from LEC/CAP
- Lease local loop wiring and co-locate at the CO
- Offer new services, such as VPNs, video, paging and cellular access
- Leverage technical know-how with value-added services

Summary

One of the most important partners in the DSL opportunity is the equipment vendor, and Ascend Communications has the experience and product families required to meet that need. Ascend has established leadership – receiving numerous industry awards – in every area of remote networking, and is the only vendor to offer a complete DSL solution.

When evaluating your vendor partner, be certain to look for:

- A scalable, end-to-end product line
- Capable, flexible and affordable products
- Integrated solutions that simplify installation, operation and management
- Support for advanced features
- Products that are real and field-proven
- Solutions for both CPE and the POP
- Solutions for both DSL and traditional WAN services
- Ability to implement DSL in profitable steps
- End-to-end network management capability
- Infrastructure and installed base compatibility
- A commitment to industry standards and interoperability
- Worldwide certification with PSTN carriers, services and switching equipment
- Technology and market leadership
- Responsive customer support

No other vendor meets these requirements better than Ascend Communications. Contact Ascend today at 800-629-9578, option 7 to begin exploring the many opportunities available through MultiDSL.
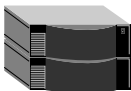
	WAN Access Switch	Management	CPE	IP Switch
Ascend	**MAX TNT**	**Ascend Management**	**Pipeline**	**GRF 400**
Market Leadership	**84% of Internet Digital Access Ports**	**Only Fully Integrated RADIUS/Firewall Real-time SNMP Platform**	**Largest Selling Internet ISDN Router**	**10X Performance Over Cisco 7500**
Industry Awards	DataComm MAGAZINE HOT PRODUCTS JANUARY 1997	NCSA CERTIFIED www.ncsa.com	1996 Winner MVP PCComputing NetGuide EDITORS CHOICE / LAN PRODUCTS OF THE YEAR	DataComm MAGAZINE HOT PRODUCTS JANUARY 1997

Figure 12 – Ascend has the industry's leading products for a total solution.

Appendix: Financial Analysis Detail

This appendix contains the detailed equipment configurations used in the financial analysis presented in chapter 6. U.S. List Price is used in all configurations.

All IDSL configuration
(168 ports with 23 Mbps of aggregate bandwidth):

Equipment	List Price
MAX TNT	$18,750
Redundant Power Supply	5,000
ISDN Software	4,000
Frame Relay Software	4,000
Hybrid Access 192 Card	9,600
(14) 12-port IDSL Cards	58,800
TOTAL	**$100,150**
PRICE/PORT	**$596**

Lease (3 years at 10% APR)
$3,266/month (lease)
$ 326/month (monthly support)
$3,592/month (TOTAL)   OR $21.38/month/port (TOTAL)

All SDSL configuration
(224 ports with 184 Mbps of aggregate bandwidth):

Equipment	List Price
MAX TNT	$18,750
Redundant Power Supply	5,000
Frame Relay Software	4,000
100 Mbps Ethernet Card	12,000
(14) 16-port SDSL Cards	119,000
TOTAL	**$158,750**
PRICE/PORT	**$709**

Lease (3 years at 10% APR)
$5,127/month (lease)
$ 512/month (monthly support)
$5,639/month (TOTAL)   OR $25.17/month/port (TOTAL)

Customer Premises Equipment

IDSL Equipment supporting a 10-user office:

Pipeline 50 ISDN (list price)	$895.00
Lease w/support (3 years at 10% APR)	$31.77

NOTE: Customers with existing ISDN routers, remote access servers or NOS server-based solutions already have the necessary CPE.

SDSL Equipment supporting a 50-user office:

DSLPipe-S (list price)	$1,495.00
Lease w/support (3 years at 10% APR)	$53.06