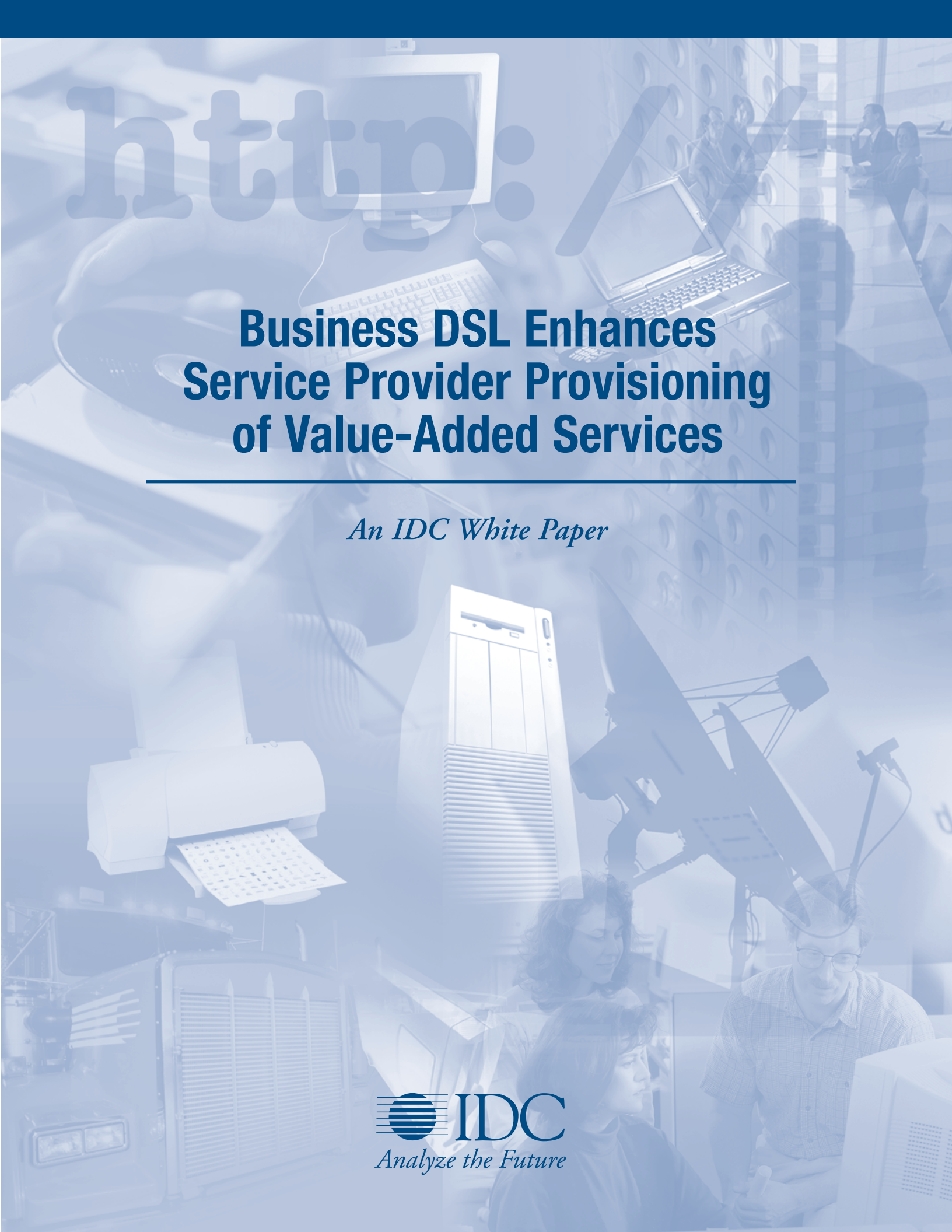

Business DSL Enhances Service Provider Provisioning of Value-Added Services

An IDC White Paper

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Pent-up demand for high-speed access to the Internet is driving triple-digit growth in both residential and business digital subscriber line (DSL) services.

Much of today's market momentum is the result of heavy promotion of residential DSL service by local exchange carriers, which were responding to competition from cable operators to provide high-speed access to the Internet. Their marketing thrust followed on the heels of network upgrades by incumbent local exchange carriers (ILECs) and data-oriented competitive local exchange carriers (CLECs). Buoyed by these efforts, the number of DSL lines in service in the United States increased from 47,000 in 1998 to 510,000 in 1999.

IDC believes the network upgrades will continue throughout 2000 and for many years to come. We project that, by 2003, there will be 12.57 million DSL lines in service within the United States, representing a five-year, compound annual growth rate (CAGR) of 205.8% (see Table 1).

The business DSL market also gained considerable momentum during 1999, with roughly 30% of all DSL lines serving business customers of all sizes. Unlike many residential customers, though, savvy businesses view DSL as more than a high-speed, always-on connection to the Internet. They see DSL as a secure, reliable, and high-speed means of accessing a number of value-added services, such as voice and video over DSL, managed firewall services, and virtual private networks (VPNs), all with the reliability they have come to expect for mission-critical, business-class access.

To capture this market, service providers will need to focus on offering these value-added services rather than basic access. By keeping customers supplied with the latest services on their existing platforms, service providers will be able to differentiate themselves from suppliers of basic Internet access, while at the same time building customer loyalty and boosting margins and profits.

Table 1
DSL Lines-in-Service Installed Base, 1998-2003 (000)

	1998	1999	2000	2001	2002	2003	1998-2003 CAGR (%)
United States	47	510	1,870	4,110	7,780	12,570	205.8
Worldwide Share (%)	67.1	78.5	70.6	62.9	54.8	46.0	-
Growth (%)	-	985.1	266.7	119.8	89.3	61.6	-

Key Assumptions:

This data examines residential and business markets.

This table counts only actual commercial lines in service, not equipment installed in advance of commercial service.

Equipment build-out in advance of service will be very high in 1999, but it will decline to parity with actual shipments by 2001.

This table examines symmetric and asymmetric DSL.

Source: IDC, 2000

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Small and medium-sized businesses (SMBs) represent a particularly attractive market opportunity. In addition to providing high-speed Internet access, smaller businesses might use DSL links to support teleworkers, while larger organizations could use DSL to interconnect branch offices. Both types of businesses care about reducing the cost of their wide area network (WAN), and DSL provides a low-cost, broadband alternative to the public switched network, ISDN, leased-line or frame-relay services.

Small businesses, branch office users, and teleworkers also want to lower their recurring voice communications costs by integrating voice and data over their DSL link. In addition, many small businesses are exploring differentiated services to ensure that mission-critical and time-sensitive applications get priority bandwidth. They are also considering managed firewall and other security services to counter increased break-in threats. With DSL, service providers can meet these customers' basic communications needs today and satisfy their thirst for value-added services as needed.

DSL use by SMBs is still in its infancy, but it is poised for explosive growth as more and more firms start to use DSL for a mix of voice and data services. IDC forecasts that small business DSL lines will increase from 60,000 in 1999 to 2.5 million in 2003, when they will account for a fifth of all DSL lines in the United States and more than three-quarters of all business DSL lines (see Tables 2 and 3). Some small businesses will elect to use cable modems. However, cable modems will be more prevalent in the residential market, because the cable plant passes only about one in five small businesses in the United States.

Table 2
U.S. Small Business DSL Line Deployment and Use, and DSL Revenue, 1998-2003

	1998	1999	2000	2001	2002	2003	1998-2003 CAGR (%)
Average monthly revenue per line ($)	125.0	118.8	112.8	107.2	101.8	91.6	-6.0
Average number of DSL lines per business with DSL	1.0	1.0	1.1	1.1	1.1	1.1	2.5
Growth (%)	N/A	561.2	718.2	115.5	64.3	49.2	-
Small business DSL annual revenue ($M)	2.6	50.7	385.2	995.3	1,690.3	2,348.2	290.1
Small business DSL lines in service (M)	0.0	0.1	0.5	1.0	1.7	2.5	209.9
Small businesses with DSL lines (M)	0.0	0.1	0.5	1.0	1.5	2.2	202.4
Total number of small businesses (M)	7.4	7.5	7.7	7.8	8.0	8.2	2.2

Key Assumptions:

The use of DSL technology for delivering high-speed data services will continue to expand, as will the use of the technology for VoDSL.

Although DSL will be used to provide both Internet access/data and voice services, Internet/data will be the primary driver of DSL to the household.

HDSL technology used for T1 deployment is excluded from the forecast.

Revenue estimates reflect fees paid to retail service providers for data services only. Revenue generated by additional services such as VoDSL or Internet access are excluded.

In calculating revenue estimates, one-twelfth the annual number of new customers is added each month.

Messages in the Data:

U.S. small business DSL lines will increase from 60,000 at the end of 1999 to 2.5 million at the end of 2003.

Despite declining monthly fees paid for DSL lines, retail service provider revenue will increase because of the overall growth in line installations.

Source: IDC, 2000

Table 3
U.S. Small Business, All Business, and Total DSL Lines, 1998-2003 (M)

	1998	1999	2000	2001	2002	2003	1998-2003 CAGR (%)
Small business DSL lines	0.0	0.1	0.5	1.0	1.7	2.5	202.2
All business DSL lines	0.0	0.2	0.8	1.5	2.4	3.3	177.5
Total DSL lines	0.1	0.5	1.9	4.1	7.8	12.6	202.0
Small business share of business DSL lines (%)	50.0	33.3	62.3	68.2	71.6	76.6	8.9
Small business share of total DSL lines (%)	20.0	11.8	25.7	25.1	21.7	20.0	0.0

Key Assumptions:

DSL lines will be used by residential end users as well as small, medium-sized, and large businesses.

DSL line speeds used by residential and business customers will vary.

Messages in the Data:

ILECs executed a strong marketing effort in the residential market in 1999. In 2000, a greater marketing effort will be made in the business market.

Over time, the residential market will garner a greater number of DSL lines because of the greater number of residential access lines

Source: IDC, 2000

Revenue generated by sales of small business DSL links will increase from $50.7 million in 1999 to $2.3 billion in 2003 (see Table 4). This forecast only includes revenues generated by underlying DSL transport. Service providers will also generate revenues from Internet access and value-added services, such as voice, video, firewall, VPN, premium services, and Web-site hosting.

IDC forecasts that small businesses will generate 41.5% of all DSL line revenue in 2003 and 70% of business DSL revenue. Service providers' revenue growth will be driven

Table 4
U.S. Small Business, All Business, and Total DSL Line Revenue, 1998-2003 ($M)

	1998	1999	2000	2001	2002	2003	1998-2003 CAGR (%)
Small business DSL line revenue	2.6	50.7	385.2	995.3	1,690.3	2,348.2	290.1
All business DSL line revenue	11.0	220.4	844.4	1,738.5	2,638.2	3,355.5	214.0
Total DSL line revenue	14.5	299.1	1,134.6	2,425.8	4,010.3	5,664.9	229.9
Small business share of business DSL revenue (%)	23.6	23.0	45.6	57.3	64.1	70.0	24.2
Small business share of total DSL revenue (%)	17.9	17.0	34.0	41.0	42.1	41.5	18.2

Key Assumptions:

Competition among DSL providers will drive price-based competition in the small business high-speed Internet access service market.

High-speed Internet access services will bundle voice and value-added services such as Web site hosting.

Message in the Data:

Small business DSL revenue will represent an increasing share of total DSL revenue.

Source: IDC, 2000

by expanding the installed base of customers and by selling more value-added services, which is an attractive business model because it maximizes revenue margins.

Critical Success Factors

As the market grows, the number of DSL service providers is also mushrooming. Some are facilities-based providers that have deployed the equipment needed to offer DSL service in ILEC central offices. Others are resellers that bundle the DSL circuit with their own Internet access service. A growing number of Internet service providers (ISPs) are reselling DSL out of fear of losing customers that want to upgrade to a high-speed link or as a way to differentiate their service offering.

The number of regional DSL providers is also growing. Many regional providers aspire to "go national" once they build brand recognition and gain experience on a smaller scale. To be successful, DSL service providers must have both technical and marketing savvy and must identify the right mix of service pricing and feature sets that will attract and retain customers.

Each type of service provider has its own obstacles to overcome and advantages to exploit. ILECs need to retain customers while scaling their networks — all in the face of challenges from cable operators, CLECs, and other service providers. ILECs need a simple turnkey solution that enables them to quickly establish market leadership in data services. They also need to relieve the congestion of their voice networks caused by dial-up Internet users who stay online for hours. DSL can help to do that.

To date, ILECs have focused much of their DSL marketing on residential customers to relieve the congestion in their voice networks and to counter the cable operators' initial success in selling cable-modem services to that market. Nonetheless, ILECs will soon focus more attention on the small business market because it is coming under siege from a growing number of ISPs, CLECs, and data local exchange carriers (DLECs).

Competitive providers are offering a variety of packages along with high-speed Internet access, including voice over DSL, managed security services such as firewalls and VPNs, premium services with service level agreement (SLA) guarantees, Web-site hosting, site development, and remote access services. Providers may also offer services, such as LAN administration, that extend into the small business location. Such a portfolio of services is typically configured and sold to the business on a customized basis.

In the small business market, DSL puts the ILECs between a rock and a hard place, because it has the potential to erode other data services, such as those provided through T1s. In the first sales wave, DSL has primarily migrated dial-up users to higher-speed services at a lower cost than T1s.

CLECs that traditionally offer only data DSL services will need to move fast to market, quickly expand their footprint, and address revenue concerns if they are to succeed. Their strategy is typically to sell to high-value teleworkers and small business customers who are ready for DSL today. By moving quickly, they hope to grow market share as their reach and customer density increases. Additionally, by offering value-added services, CLECs hope to differentiate themselves and develop better customer loyalty.

Likewise, Internet service providers (ISPs) need to think beyond offering basic Internet access, which is rapidly becoming a commodity. To survive and thrive, ISPs need to be able to rapidly scale service provisioning capacity and to offer tiered services, while eliminating customer churn. Their business model should emphasize upselling customers from basic Internet access to value-added services as they migrate from dial-up.

With DSL, value-added resellers (VARs) also have an opportunity to offer existing small business customers a cost-effective and speedy alternative to analog modem, ISDN, or T1 service in order to generate new revenue streams. Offering DSL also gives VARs a better chance of retaining customers as they upgrade. At the same time, service providers can expand their reach and significantly reduce deployment costs by utilizing VARs to acquire new customers and install business DSL customer premises equipment (CPE).

Value-Added Focus

So far, service providers have seized the lion's share of small business CPE revenue primarily because they have been able to offer the speed and always-on features of DSL at very competitive prices. The greatest opportunity, though, comes from focusing on the added value of business DSL services such as toll-quality voice, differentiated classes of service, security, VPN, and video services, including distance learning and videoconferencing.

Many small business customers may not want VPN or video services today but they may in the future. Deploying DSL as an enabler of such value-added services allows the provider to satisfy customers today and add to the service portfolio as needs arise. Service providers may find decreasing numbers of customers for the various types of services as they move up the value chain. However, each new service brings increased margins and allows service providers to differentiate themselves from competitors while increasing customer "stickiness" or loyalty.

Prompted by shrinking IT budgets and the increasing complexity of managing a huge network, business customers are asking service providers to supply not only transport but also

the provisioning, configuration, support, and even the remote monitoring of their customer premise routers. By outsourcing these tasks, businesses hope to achieve substantial savings in equipment costs, administrative overhead, and bundled transport. The proportion of service provider customers with managed network services contracts has grown dramatically over the past three years. The movement has also begun to embrace managed security services, which range from equipment rental and software licensing to complete service provisioning.

Voice over DSL (VoDSL) is the industry direction that can truly cement continued success for DSL. With voice and data integrated across DSL, a service provider can sell to a broader range of customers and gain additional profit from each DSL line.

By taking advantage of high-speed access, service providers can integrate multiline voice services over a single pair of copper wires. This allows the service provider to offer new voice and data services without incurring the cost of a truck roll or expensive product forklift upgrade. Adoption of the H.323 standard has also allowed third parties to develop compatible voice applications to a common protocol, enabling the rapid deployment of intranet voice services for small businesses and teleworkers.

VPNs offer a means for private data to pass safely over a public network, such as the Internet. Businesses are currently making a rapid transition from dedicated private networks to VPNs for a variety of applications, including building corporate intranets and extranets and connecting remote and branch offices. DSL makes this possible with affordable high-speed access.

Video services revenues may take longer to develop, but video will become a broadly based service, and a major opportunity for service providers and resellers to deploy, especially as part of a DSL service bundle. Some of the most exciting applications for video services include teleworking, interactive distance learning, videoconferencing, telemedicine, video email, and video streaming.

DSL Deployment Time Line

The issue of which DSL technology wins or loses is critical to the ILEC, CLEC, ISP, and VAR. At the moment, there are no less than eight implemented or proposed DSL standards — 10 if you count variations. Clearly, this is an untenable situation from the viewpoint of interoperability, market health, and user acceptance. A number of DSL schemes will continue to coexist and overlap in the future, but some will fall by the wayside, having served their purpose as stepping stones in the evolutionary process.

Looking ahead, IDC forecasts a fast ramp-up worldwide for symmetric DSL services, which include IDSL, SDSL, HDSL, HDSL2, and G.SHDSL. These services will have a CAGR of 165.9% from 1998 to 2003 (see Table 5). Asymmetric DSL services, such as ADSL, will also continue to experience explosive growth as the equipment infrastructure is more widely deployed worldwide and standards stabilize.

Table 5
Worldwide Symmetric and Asymmetric DSL Lines Added, 1998-2003 (000)

	1998	1999	2000	2001	2002	1998-2003 2003	CAGR (%)
Symmetric	23	197	861	1,309	1,903	3,025	165.9
Growth (%)	-	763.8	337.8	52.1	45.4	58.9	-
Asymmetric	37	383	1,137	2,574	5,751	10,124	206.8
Growth (%)	-	929.6	196.6	126.4	123.4	76.0	-

Key Assumptions:

Symmetric DSL includes IDSL, SDSL, HDSL, HDSL2, G.SHDSL, and VDSL standards.

Asymmetric DSL includes ADSL and G.Lite standards. (VDSL can also be configured as asymmetric.)

DSL set up as symmetric (download speed matches upload) still counts as asymmetric.

Symmetric targets business; asymmetric targets residential.

Crossover will occur, with symmetric seeing some deployment at the residence and vice versa.

Messages in the Data:

There will be fast ramp-up for business-based symmetric services because this technology has already been in existence for several years.

Asymmetric will see a major growth increase in 2000, but volume growth occurs in 2001, when equipment infrastructure is more widely available on a worldwide basis and standards have stabilized.

Source: IDC, 2000

Symmetric DSL services have mostly targeted business customers and asymmetric DSL services have focused on residential customers, but each technology can be valid for either market: Full-rate ADSL is powerful enough for many small businesses, while some of the single wire-pair symmetric services could see limited residential deployment for power users.

For CLECs, the line-sharing regulation in late 1999 makes ADSL an attractive technology for both businesses and homes because they can now deploy the service without having to install new copper lines in the local loop, eliminating truck rolls and saving a lot of deployment time and cost.

The timing of the ascension or demise of specific DSL types is subject to countless variables, but DSL offerings will probably coexist and overlap until at least 2003.

Niche application exceptions aside, IDC believes IDSL, SDSL, and HDSL all have a limited future for new business service additions past 2001. HDSL2 is next in line after HDSL. Yet even its future is limited to a two- to three-year window due to the G.SHDSL proposal, which targets replacement of both SDSL and HDSL2.

ADSL can be deployed at business and residential sites and should exist through 2003. VDSL is beginning to see action and will ultimately serve as the local loop DSL backbone.

The ABCs of DSL

Digital subscriber line (DSL) services can be separated into two distinct categories: asymmetric services, which feature different downstream and upstream rates, and symmetric services, which feature two similar rates.

- **Asymmetric DSL** (ADSL) service was originally targeted at consumers, in part because it matches the asymmetric pattern of residential Internet traffic, where user queries, messages, and other upstream data usually account for a fraction of the downstream responses. ADSL downstream rates may reach up to 8Mbps and upstream rates to 1Mbps at distances within 12,000 feet of the central office. A version known as G.Lite, which does not require a splitter on the customer premises to separate the voice and data traffic, is restricted to downstream speeds of 1Mbps and upstream speeds of 385Kbps.

  Increasingly, though, ADSL is being adopted for use by business. Standards-based ADSL is a promising business solution because it allows service providers to increase revenue by running traditional plain old telephone service (POTS) and data across the existing copper infrastructure. ADSL is currently the only DSL technology that allows service providers to offer voice and data services without requiring a truck roll to install new equipment or pull new lines. The upstream speed of ADSL is generally sufficient for most small business applications, including Web access, email, videoconferencing, and distance learning.

- **Symmetric DSL** (SDSL) is better suited for offices that require upstream speeds greater than the 640Kbps offered by ADSL. SDSL uses 2B1Q modulation over a single twisted pair and can be provisioned for variable-rate connections at symmetric upstream and downstream rates ranging from 160Kbps to 2Mbps. There is no standard implementation of SDSL. Each chipset vendor uses a proprietary scheme, preventing interoperation. SDSL faces strong competition from upcoming standards and is not likely to survive as a mainstream DSL technology.

- **High bit-rate DSL** (HDSL) is another version of symmetric DSL that uses 2B1Q modulation but over two-wire pairs (four wires). HDSL targets business deployment only. Known as a "T1 replacement" technology, HDSL only operates at the full rate of 1.5Mbps. It is transparent to the user because the telephone companies own and operate the HDSL equipment and provide the user with a conventional T1/E1 interface. Service providers like HDSL because they can transport a full-duplex T1/E1 across existing twisted-pair copper without repeaters.

  In addition, HDSL can accommodate bridged taps, which are twisted pairs bridged onto the main transmission path. Bridged taps cause a form of transmission impairment that T1 repeaters cannot accommodate. HDSL also offers better spectral compatibility with existing services than standard T1 circuits. Two-wire pairs add distance and a certain level of robustness to the service, but HDSL's long-term outlook is threatened by emerging standards.

Looking at each DSL scheme more closely, we expect the following:

- **IDSL** will evolve into a niche technology and should survive past 2001 but not in mainstream DSL deployments. U.S.-based ILECs have shown little interest in supporting this standard, though it can be used to extend network distances and aggregate low-speed lines.
- **SDSL** works well now and is widely supported, but it will not survive past 2000. There are too many superior standards on the books, some specifically directed toward replacing SDSL.
- **HDSL**'s life span is more difficult to determine. HDSL offers robustness and has a strong installed base. Still, the emergence of HDSL2 and (near yearend 2000) G.SHDSL, will see HDSL wind down by late 2001.
- **HDSL2** is expected to replace HDSL because it offers spectral compatibility and can coexist with ADSL, runs on a single wire pair, and has strong backing from some key vendors. Still, IDC sees the scheme lasting only through 2002 due to emerging next-generation standards.
- **G.SHDSL** is the wildcard DSL technology. It is proposed as the combination of SDSL and HDSL2. The

- **HDSL2** is one such emerging standard. It provides a full-rate-only symmetric service, but over a single twisted pair. HDSL2 was conceived specifically to work alongside asymmetric services such as ADSL without causing interference, a feature known as "spectral compatibility." For service providers, this coexistence with ADSL is crucial, but it comes with a price tag three to five times greater than HDSL's. Still, with silicon costs dropping fast and DSP processing capabilities increasing continually, HDSL2 is currently best positioned for business DSL services.
- **ISDN-based DSL** (IDSL) is targeted mainly at small and home offices. It provides a symmetrical service of 128Kbps in each direction using ISDN equipment. With a single repeater, IDSL can carry signals up to 30,000 feet. With multiple repeaters and configured as a digital loop carrier (DLC), it can carry signals well past 20 miles. Therefore, IDSL is an extender technology for the U.S. market. It also fills a niche for residential connections where other forms of DSL are impractical because of bridge taps, distance, or line quality.

  IDSL defines only the physical line code, so it can be used with existing customer premises equipment and a variety of protocols supporting ISDN, analog, and frame relay services. Accordingly, it is likely to serve as a bridge between current hardware environments and future, more advanced DSL services.
- **Very high data rate DSL** (VDSL) can operate at downstream speeds of 52Mbps and upstream speeds of 2.3Mbps, depending on the length and condition of the line, making it suitable for high-speed Internet access, video on-demand and interactive multimedia applications. It is a component of a proposed fiber-to-the-curb network architecture, where fiber from the central office would get dropped to the neighborhood closet-sized DLC cabinet. Existing copper connections then run to the home, delivering much higher bandwidths. Due to the newness of the technology, VDSL will see limited deployment in 2000.

  As observed, a whole laundry list of DSL standards exists. For the market to truly thrive, there must be strong consensus of opinion for a single business DSL solution to emerge for both North America and Europe. HDSL2, for example, will need to offer greater rate flexibility to gain widespread acceptance with CLECs and in international markets. Multirate operation allows CLECs and European PTOs to provision different levels of service, at different monthly fees, depending on their customer needs.
- An International Telecommunications Union (ITU) proposed standard, **G.SHDSL**, shows the greatest promise for the business DSL market, combining the best of SDSL and HDSL2. Like SDSL, the standard will define multirates but with the spectral compatibility of HDSL2. According to the ITU committee, October 2000 is the target date for the "final" round to ratify the standard.

ability to offer T1 and multirates across single twisted pair, all on an international-based standard, suggests a strong winner. Yet not much is known about G.SHDSL, and standards experts suggest we are a year or more away from it emerging as an approved standard. IDC sees G.SHDSL going strong through 2003 and beyond.

- **ADSL** is the strongest asymmetric technology and could see service in both business and residential markets. It should survive through 2003.
- **G.Lite** will be successful through 2002, but its survivability beyond that is questionable since its popularity already appears to be losing momentum. To survive, it will need to undergo a metamorphosis to shed its perception as ADSL's lower-powered cousin.
- **VDSL** works in combination with other DSL technologies, installed between the central office and digital loop carrier (DLC). As ILECs reach further into neighborhoods, they will link DSL with DLCs to eventually offer high-bandwidth services such as video. There are numerous unanswered questions regarding opening up DLC to competitors, and there are compatibility issues between VDSL and the installed based of DLCs. Regulatory and technical issues aside, VDSL will see limited deployment in 2000 but is likely to see widespread use beginning in 2001. A few ILECs and vendors have already announced its availability.

Equipment Considerations

To enable differentiated classes of service, a DSL router needs quality-of-service (QoS) features, such as class-based weighted fair queuing (CBWFQ), and traffic management capabilities, such as ATM per virtual circuit queuing. QoS features allow the router to expedite the handling of mission-critical or delay-sensitive applications, while sharing network resources with lower-priority applications.

The new Cisco 827 business-class ADSL router, for example, uses CBWFQ to allow a service provider to guarantee or differentiate bandwidth based on a specific application or user. Additionally, this router uses committed access rate to classify and tag traffic packets or simply rate-limit traffic for identified applications or users. In addition to IP QoS features such as CBWFQ, the Cisco 827 provides ATM QoS capabilities so service providers can manage their core ATM network infrastructure and ensure that delay-sensitive applications such as voice get priority.

Intended for small offices with up to 20 office workers or teleworkers, the router provides toll-quality voice and a variety of security features. The Cisco 827-4V model, with four voice ports, is an H.323 standards-based voice over IP gateway, or an integrated access device, that can be software upgraded to voice over ATM for voice over DSL services. Its business-class security features allow service providers to offer managed firewall services to small business customers seeking protection from break-ins, as well as VPNs for secure and reliable communications with teleworkers and workers in branch offices.

With the router's software-upgradable platform, service providers can offer basic DSL services today and add new capabilities as customer needs grow. Also, its diagnostic features and use of Cisco IOS technology allow service providers to deploy the router at the customer's premises and manage it remotely.

Conclusion

Small businesses represent a particularly attractive market for DSL services. Revenue generated by sales of small business DSL links alone will increase from $50.7 million in 1999 to $2.3 billion in 2003, accounting for 41.5% of all DSL line revenue in 2003 and 70% of business DSL revenue. Internet access and value-added services, such as toll-quality voice, differentiated classes of service, security, VPN, distance learning, videoconferencing, and other video services, will take the revenue figures significantly higher.

To capture this burgeoning market and maximize profit margins, service providers will need to focus on these value-added services rather than simple access. By keeping customers supplied with the latest services on their existing platforms, service providers will be able to differentiate themselves from suppliers of basic Internet access, while at the same time building customer loyalty and boosting margins and profits.

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