Ascend

Digital Subscriber Line (DSL) MultiDSL

FAQ

1. *What is DSL?*

   DSL stands for Digital Subscriber Line. Local Exchange carriers currently use a single unshielded twisted pair of wire for transmitting voice, which requires 300-3,400 Hz of bandwidth on the local loop (between Central Office and Customer Premises). The wires are, however, capable of carrying information at much higher rate when modern digital processing techniques are deployed. The same pair of wires are used successfully worldwide to provide ISDN services yielding up to 128 Kbps. The explosive growth in Internet access, remote LAN access and telecommuting demand data rates that are a lot higher than what is available today over the existing pair of wires. DSL technologies utilize a bandwidth of up to 1.2 MHz on the local loop and facilitates data speed from 164 Kbps to as high as 7.0 Mbps.

2. *What is a MultiDSL?*

   Ascend's MultiDSL™ is a family of DSL products that include both Central Office Equipment (COE) and Customer Premises Equipment (CPE) for a wide range of DSL technologies including IDSL, SDSL, RADSL-CAP and RADSL-DMT. These technologies utilize the existing pair of copper wires between the Central Office (CO) and the residences/businesses. The MultiDSL products for CO permit carriers to launch high-speed access services from 64 Kbps to 7.0 Mbps. The COE consists of DSL line cards for the DSLTNT™, MAX™ 4002, 4004 and MAX TNT™ family of products. The DSLPipe™ family offers CPE products for the various DSL technologies. With the MultiDSL offering, Ascend becomes the only vendor in the industry to offer a true integrated DSL solution for both COE and CPE.

3. *What is IDSL?*

   IDSL is a technical innovation from Ascend and the first of a series of DSL product offerings from Ascend. It stands for ISDN Digital Subscriber Line (IDSL). IDSL uses the 2B1Q line coding standard for ISDN BRI circuits. Used for data-only applications, IDSL operates at 128 Kbps for up to 18,000 feet.

   Because IDSL uses the same industry-standard line coding technique as ISDN, customers with ISDN BRI terminal adapters can use their current TAs, routers and bridges for connecting to IDSL lines. Any of the commonly used transport protocols such as PPP, MP, MP+ or Frame Relay may be used over the IDSL line, allowing rapid and transparent integration into Internet, remote LAN access and telecommuting

   The IDSL line will terminate at the DSLTNT, MAX TNT, a MAX 4002 and 4004 at the Central Office (CO), and the data will be further transmitted over a Frame Relay backbone network. IDSL lines provide dedicated access to packet switched network, and customers subscribing to IDSL services can connect to any of the pre-defined services such as Internet access or destinations such as corporate headquarters.

   As part of the IDSL solution, Ascend offers IDSL line cards for the MAX 4002, 4004 and MAX TNT for the CO as well as the Pipeline® products for the CPE.

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4. *What is SDSL?*

   SDSL is the Symmetric Digital Subscriber line, also known as single pair HDSL, which operates on existing single copper wire between the CO and the residence. It offers a speed of 768 Kbps, which is half the T1 rate for up to 12,000 feet. With Ascend's SDSL, two of the SDSL ports may be combined over two pairs of wires to offer T1 speed of 1.54 Mbps symmetric datarate.

5. *What is an RADSL?*

   RADSL stands for Rate Adaptive Asymmetric Digital Subscriber Line and offers a downstream (from CO to residence) data rate of 7.0 Mbps and an upstream (from residence to CO) speed of 1.0 Mbps. RADSL can use either Carrierless Amplitude Phase (CAP) modulation or Discrete Multi-Tone (DMT) modulation. Rate Adaptive DSL dynamically adapts to the condition of the line.

6. *What is a CAP and DMT?*

   CAP and DMT are two different forms of line coding techniques used with RADSL technology. The main difference between these two line coding methods is in determining the optimum speed between the CO and the residence/business over a single twisted pair of wire. CAP treats the entire frequency spectrum as a single channel and optimizes the datarate while DMT divides it into 256 sub-channels and optimizes the datarate for each sub-channel. CAP has been tested longer than DMT, but DMT has been accepted as the standard by ANSI and ETSI.

7. *What is Ascend's position on CAP and dMT?*

   Ascend remains line code neutral by offering both CAP-and DMT-based RADSL technologies for the COE and CPE.

8. *How can I integrate voice over the same copper wire (splitters)?*

   ADSL: You can integrate analog voice and data over the same single pair of wire between CO and residence/business with the ADSL technology. This is accomplished by using a splitter at the customer premises and at the central office. Splitters work in pairs. The splitter at the subscriber site provides connection to analog phones and the RADSL CPE; the splitter at the central office connects the analog voice to PSTN and the ADSL to the COE such as a MAX TNT.

   IDSL: Voice and data can be integrated over a single pair of wires using IDSL. This does not use splitters.

9. *How can we get 1.54 Mbps speed using SDSL technology?*

   Ascend's DSLPipe-2S permits using two SDSL lines (2 pairs of wires) to offer 1.54 Mbps with Multilink protocol.

10. *What is a VDSL?*

    VDSL stands for Very-high-bit-rate Digital Subscriber Line operating at up to 52 Mbps downstream and 2.3 Mbps upstream for 1,000 feet. Unlike the other DSL technologies that use existing twisted pair of copper wire, VDSL requires fiber optic cable between the CO and the residence.

11. *Is VDSL part of Ascend's MultiDSL offering?*

    No. VDSL is not part of Ascend's MultiDSL offering at this time since MultiDSL products are offered to leverage existing copper wires between the CO and the residence. VDSL requires fiber optic cable.

12. *What are the maximum speeds for each one of these DSL and other services?*

    The table below compares the various DSL technologies to each other as well as to the analog, digital and cable alternatives.

Technology	Upstream	Downstream	Life Line Voice	Distance (feet)	Comments
Analog Modems	33.6 Kbps	56 Kbps	Yes	18,000	Universal (PSTN, Cellular)
ISDN BRI	128 Kbps	128 Kbps	No	18,000	Pervasive
ISDN PRI	1.54 Mbps	1.54 Mbps	No[1]	12,000	Pervasive
T1	1.54 Mbps	1.54 Mbps	No[1]	12,000	Pervasive
IDSL	128 Kbps	128 Kbps	No	18,000	2B1Q signalling and ISDN groomed
SDSL[2]	768 Kbps	768 Kbps	No	12,000	Local loop
HDSL	1.54 Mbps	1.54 Mbps	No[1]	12,000	Used now for T1: SDSL can be extended to offer HDSL
ADSL (DMT)	176 Kbps 224-640 Kbps	1.54 Mbps 6.14 Mbps	Yes Yes	18,000 12,000	Trials only 1997/1998 availability
ADSL (CAP)	1.0 Mbps 1.0 Mbps 544 Kbps	7.0 Mbps 2.56 Mbps 640 Kbps	Yes Yes Yes	10,000 12,000 17,000	Trials only, limited vendor support, 1997 availability
VDSL	640 Kbps 1.6-2.3 Mbps	13 Mbps 52 Mbps	Yes Yes	4,500 1,000	Requires fiber optic cable
Cable Modems	0-768 Kbps May require separate line	30 Mbps Shared media	No	N/A	Trials only, no standards 1997/1998 availability

[1] Voice communications requires special customer equipment and/or cannrier provisioning.

[2] 2 SDSL lines may be combined to offer 1.54 Mbps over 2 pairs of wires.

13. *What is the DSLPipe family of products?*

    The DSLPipe products are Customer Premises Equipment (CPE) and are part of Ascend's MultiDSL family of products. The DSLPipe includes DSLPipe-S (1 port SDSL), DSLPipe-2S (2 port SDSL), DSLPipe-C (RADSL-CAP) and DSLPipe-D (RADSL-DMT).

14. *Why doesn't DSLPipe include CPE for IDSL services?*

    Since IDSL is not a proprietary technology but uses 2B1Q standards-based line coding, any ISDN BRI TA, bridge and router including Ascend's Pipeline products (e.g. Pipeline 50/75/85/130) can be used as the CPE for IDSL services at 128 Kbps.

15. *What is the availability of all these DSL products?*

COE Products	Available
IDSL line card for MAX 4002 and 4004	Now
IDSL line card for MAX TNT	Now
SDSL line card for MAX TNT	Now
RADSL-CAP line card for MAX TNT	Now
ADSL-DMT line card for MAX TNT	Q4 1997

CPE Products	Available
IDSL-based CPE (Pipeline)	Now
SDSL-based CPE (DSLPipe-S)	Now
ADSL-CAP-based CPE (DSLPipe-c)	Now
ADSL-DMT-based CPE (DSLPipe-D)	Q4 1997
2 port SDSL band CPE (DSLPipe-2S	Now

16. *What transport protocols are supported by DSL technologies?*

DSL technology is based on the physical layer (Layer-1 of the OSI model). It can use any of the available transport protocols including but not limited to, Point-to-Point Protocol (PPP), Frame relay and Asynchronous Transfer Mode (ATM). Ascend's MultiDSL products utilize PPP, MP, MP+ as well as frame Relay at the data/network layer to ensure seamless fit in the existing infrastructure.

17. *What are the major applications for DSL services?*

Internet access, telecommuting, remote office connectivity, multimedia and videoconferencing are some of the major applications that demand high bandwidth. All of these applications can be efficiently served by the DSL technologies.

18. *Why are there so many variations of DSL technologies?*

Different applications require different data rates, and the various DSL technologies deliver those speed variations. For example, IDSL delivers services at 128 Kbps, SDSL at 768 Kbps or 1.54 Mbps. RADSL-CAP at 64 Kbps/1.0 Mbps upstream and 640 kbps/7.0 Mbps downstream, and ADSL-DMT at 176/640 Kbps upstream and 1.54/6.14 Mbps downstream.

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