Ascend

Competitive Analysis

MultiDSL

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ASCEND

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1. Purpose

The purpose of this bulletin is to provide a comprehensive analysis of the Ascend MultiDSL™ product line vs key xDSL competitors, and to help Field Sales effectively position Ascend's MultiDSL products against key competitors.

2. Competitive Landscape

While there are over a dozen manufacturers of xDSL products at this time, only seven market end-to-end solutions that include Customer Premises Equipment (CPE) and equipment for the Central Office (CO). Some of these solution providers are marketing xDSL to the telco as a complete solution, selling the CPE and CO equipment together as a package, with pricing to the telco for each subscriber line (not for each piece of equipment).

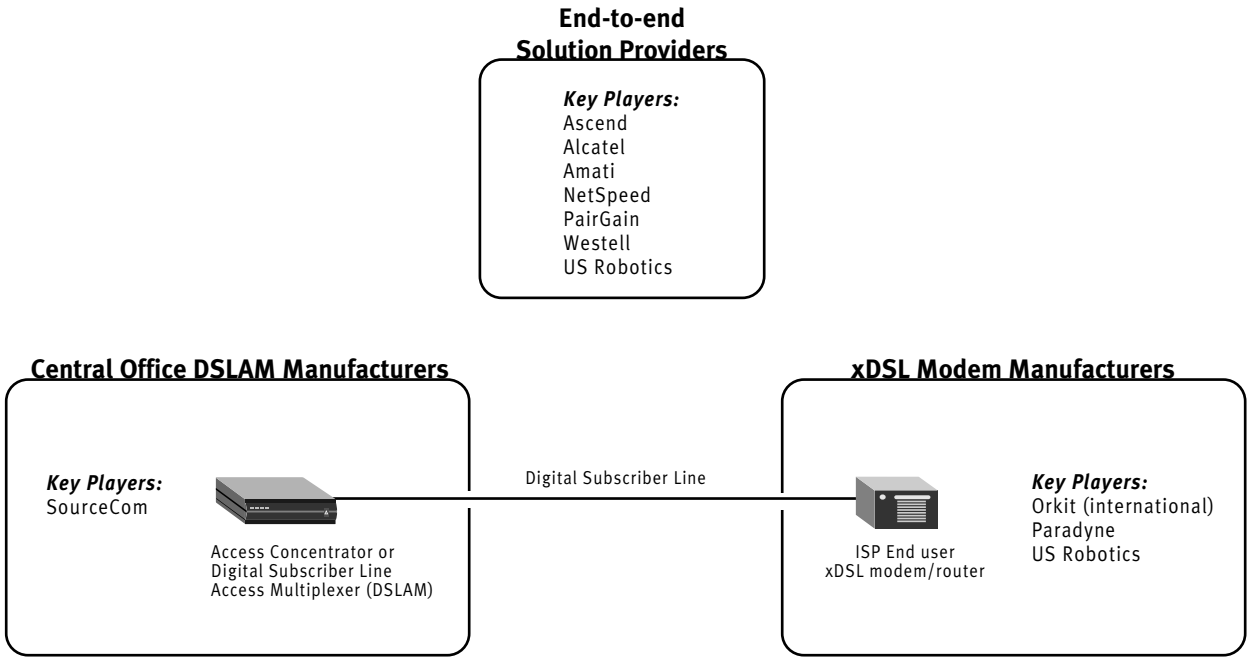

Figure 1 –

3. Product Description — Key xDSL Competitors

Alcatel

Introduced in summer 1996, the Alcatel 1000 system is designed to combine ADSL-DMT and ATM technologies and includes rate adaptive modems and a Central Office modem bank that bridges the LAN from the CPE to the CO. Alcatel uses its own "DynaMiTe" chipset. In the fall, Alcatel's DSL RFP was accepted by a consortium of four RBOCs.

- A1000 Network Termination client-site modems support from 1.54 to 6.14 Mbps downstream and 176 to 640 Kbps upstream. Alcatel manufactures a separate POTS splitter.

Estimated telco cost per subscriber line: $500

- A1000 Access Adapter CO equipment supports ATM and Frame Relay, with a density of four ports per termination board. Maximum port density is not mentioned.

Not disclosed

Amati

Amati holds DMT patents and their ADSL-DMT technology has been awarded the ADSL standard. Its rate adaptive CPE products have been available for over a year, and in January 1997 they introduced a CO modem bank — the Allegro. The Allegro provides a platform for a new version of the Overture 8 modem that bridges the DSL line at both ends and offers features not originally available in their first generation products, such as: software upgrades; rate adaptive power mode; SNMP management; and data packet buffers.

Telco cost per subscriber (includes client modem and CO modem) : $2,000 to $2,500

- The Overture 8 supports ADSL-DMT at 1.5 to 8 Mbps downstream and 640 Kbps upstream and includes a POTS splitter to separate voice and data frequencies.

- Allegro holds 12 ADSL-DMT modems per shelf, for a maximum port density of 48.

Netspeed

In January ’97 Netspeed announced a suite of CO and CPE ADSL-CAP products using the GlobeSpan chipset (Support of Motorola/Amati DMT is promised for future applications). Netspeed is emphasizing its “QuickDial” dial-on-demand technology, and “Broadbond” ADSL inverse multiplexing, that allows service providers to aggregate DSL modems according to bandwidth demands. The line is managed using ViewRunner, Netspeed’s SNMP application for HP Openview, and Telnet capability is promised by spring ’97.

• SpeedRunner 100 routers are 10Base-T Ethernet to ADSL routers that deliver 1-2 Mbps downstream and up to 1 Mbps upstream; these routers can be configured for SDSL at rates up to 960 Kbps. They support IP, IPX and bridging, and can be used as modem pools at the service provider.)	$1,295
• The SpeedRunner 200 router has the same features as the 100, but delivers up to 8 Mbps downstream and 1 Mbps upstream	$1,695
• The SpeedRunner 300 is a multiport ADSL inverse multiplexer with one 10Base-T Ethernet port and three ADSL ports. It has routing capability and is designed for the remote office, or as an Internet gateway, and is promised to be available first half ’97. The SpeedRunner 300 is rate adaptive and will deliver 8 Mbps downstream and 1 Mbps upstream to each port.	$8,995
• LoopRunner is a scalable DSL Access Multiplexer (DSLAM) planned for release in first half ’97. It is planned to support V.34, ISDN, DS1, DS3, OC-3c ATM, and Frame Relay, and automatically detect ADSL signaling (CAP vs. DMT). LoopRunner will be marketed to service providers for its modem pooling features – that allow a ratio of up to six subscribers/modem – and its scalability – the company claims up to 12 DSLAMs can support up to 4992 users.	$200-$500 per port $15,995 for SNMP-management application
• Netspeed also promises to introduce a remote access server – the FireRunner – that will be able to route, authenticate and secure ADSL traffic and will support up to three WAN ports (OC-3c, DS3, and DS1).	$19,995

Orckit

Based in Tel Aviv, Orckit has sold modems to France Telecom and Telia (Sweden), and participated in trials with Deutsche Telecom, Bell Canada, and US West. Orckit manufactures HDSL, VDSL and ADSL-DMT modems as the CopperTrunk product line. While not available yet, the company has announced it will offer an xDSL access system to telcos in the future.

Estimated cost per subscriber line: $2,500 – expected to be $1,500 by end of '97

- ORcom is an HDSL-based modem that supports E1 functionality at 2 Mbps up and downstream.
- ORsingle is a SDSL modem with POTS splitter that also supports E1 functionality at 2 Mbps up and downstream.
- ORvision ADSL-DMT with ATM interface supports up to 8.2 Mbps downstream and 640 Kbps upstream.
- ORspeed I VDSL modem, in prototype, can interface with copper or Fiber to the Curb (FTTC) at speeds from 13, 26, or 52 Mbps downstream and 2 Mbps upstream.

Paradyne

Paradyne has three HotWire products that address SDSL/HDSL, rate adaptive ADSL-CAP modems and a Central Office Digital Subscriber Line Access Multiplexer (DSLAM). Paradyne uses the GlobeSpan chipset, and provides SNMP through its DCE Manager application for HP OpenView. To address the problems imposed by bridging multiple Ethernet LAN onto a single segment, Paradyne claims the products feature "unique filtering techniques" to optimize traffic and prevent unauthorized access to subscriber information but no security/firewall per se. Formerly a division of AT&T and then Lucent, Paradyne products are distributed by Lucent and other resellers.

- The HotWire 5100 series offers rate adaptive ADSL-CAP modems at 640 Kbps to 2.56 Mbps downstream and 272 Kbps to 1.08 Mbps upstream and incorporates a POTS splitter. Paradyne has recently shipped this product to a Canadian ISP for its first commercial deployment.

Depends on configuration

- The HotWire 8800 multiservices DSLAM is advertised to consolidate up to 72 DSL ports/shelf, or 576 ports per rack in a telco shelf. It can handle IP and Frame Relay and is planned to ship in May, 1997.

$950-$1,500 per port

- The HotWire 7900 series has HDSL and SDSL access products for telcos and large campus networks to connect to T1/E1 services over long loops.

PairGain

PairGain claims to be the market leader in High-Bit Data Rate Digital Subscriber Line (HDSL) products and systems; in early February '97, they released rate adaptive ADSL-CAP modems, an xDSL Multiplexer (DSLAM) and gateway. On February 19th, the company acquired AVIDIA, a developer of ATM DSLAM products. PairGain's products support SNMP, HDLC or PPP encapsulation, and transparent MAC-layer bridging with Spanning Tree. PairGain was an early market entrant, providing modems to many telco trials, and they intend to provide an end-to-end xDSL solution.	Estimated cost per subscriber line: $1,000 to $2,500
• Megabit Modem 768 delivers 768 Kbps up and downstream using an HDSL network interface. A POTS splitter will be available in summer '97.	$795 (NIC) $1695
• Etherphone RT provides the same HDSL speeds via a POTS line.	$795 (NIC) to $1395
• Megabit Modem HRA is a rate adaptive HDSL modem that delivers 1 Mbps up and downstream (available summer '97).	$1195
• Megabit Modem CRA is a rate adaptive ADSL-CAP modem that delivers 2.5 Mbps downstream and 1 Mbps upstream using GlobeSpan's chipset (available summer '97).	$1695
• Megabit Modem C1500 is also a rate adaptive ADSL-CAP modem that is targeted at the consumer. It delivers 1.6 Mbps downstream and 64 Kbps upstream, and has POTS splitter (available summer '97).	$1595
• AccessHub is a DSLAccess Multiplexer that can support up to 14 10Base-T Ethernet ports; Hubs can be cascaded to support up to 146 ports in a telco rack. (promised for Q1 '97).	$995
• AccessGate is a backbone gateway for the DSLAM with a T1 serial port. It is a single-slot line card that performs Ethernet bridging (promised for Q1 '97).	$1295

SourceCom

SourceCom currently manufacturers a xDSL CO product only – not an end to end solution. In fall 1996, SourceCom introduced its modem bank (DSL Access Multiplexer) BANC 6000.

• The BANC 6000 scales from 32 ports to 1024 ports per BANC group of 32 BANC 6000s. The BANC 6000 has ATM OC-3c support and claims to be compatible with all variations of XDSL, thus allowing the access network provider to support heterogeneous transmission technologies within the same rack. SourceCom's software supports PPP, HDLC, and Frame Relay, and routes IP and IPX.	$700-$1000 per port
• SourceCom also makes SOHO Routers and Access servers that they claim will support xDSL.	

US Robotics

In March '97, USR announced the new USR Viper RADSL modem targeted at the branch office, SOHO, and telecommuter market segments. In addition, USR announced AxCell, a new cardset for the Total Control Chassis.

• The USR Viper RADSL modem with POTS splitter delivers ADSL-CAP at 1.5 Mbps downstream and 384 Kbps upstream in its initial release. USR says a software upgrade that will increase the speeds to 6 Mbps downstream and 640 Kbps upstream, will be available for customer download sometime in Q2 '97.	$545
• The Total Control chassis can hold up to 16 dual-port AxCell cardsets, for a maximum density of 32 ports. The system requires an interface with an Ethernet switch (USR TotalSwitch) and can interface with the NetServer for Frame Relay service, or with a third-party router.	$47,113 $875/card $388/port

Westell

Westell has been offering DSL products for over four years, originally designing and positioning its products to deliver video to the home over telco wires. Although DMT was chosen as the standard, because it is available and ready for deployment the FlexCAP ADSL-CAP product was involved in some early, small text markets with NYNEX, PacBell, Bell Atlantic, USWest, Ameritech and GTE. Today, Westell has a range of HDSL and ADSL-CAP products for the subscriber and Central office, and promises to have ADSL-DMT in the future. Westell's products are managed by "AccessVision" – a standards-based system compliant with the Telecommunications Network Management (TMN) architecture and compatible with Simple Network Management Protocol (SNMP), and Common Management Protocol (CNMP).

- FlexCAP ADSL provides 1.544 Mbps downstream and a bi-directional control channel up to 64 Kbps. The FlexCAP components support video and data dialtone (services with Ethernet bridging and routing).

Estimated: $1,200 to $1,500 per subscriber line

- InterAccess E1 HDSL system also supports Video and data dialtone; it is supports full duplex speeds of 2.048 Mbps, and is available with either E1 or data interfaces to the LAN/WAN.

- The Supervision CAP rate adaptive ADSL system delivers from 640 Kbps to 8.192 Mbps downstream, and from 272 Kbps to 1.088 Mbps upstream and includes a POTS line and an ATM 25 Mbps interface. This modem bank pairs with Westell's SuperVision broadband multimedia multiplexer located at the central exchange office, which consolidates access lines into a 155 Mbps interface to the switch. This system is distinguished from FlexCAP by its rate adaptive capability, which can automatically select upstream and downstream rates based upon specific loop and noise impairments.

4. Ascend MultiDSL Competitive Advantages

The Only Viable Solution for telcos, ISPs and Corporate Enterprises

- Ascend's DSLPipe™ products are routers, not just modems; therefore Ascend's DSL products are routing the traffic to the destination, not just bridging as with other xDSL products.
- DSLPipe users can use registered IP addresses or utilize Network Address Translation (NAT) functionality and use unregistered /private IP addresses.
- Ascend is the only vendor with a fully integrated DSL product line for Central Offices and Customer Premises that includes ISDN DSL (IDSL), SDSL, HDSL, ADSL-CAP and ADSL-DMT. This integrated product line allows service providers a turnkey solution they can implement TODAY, with the ultimate investment protection and migration strategy for the future.

IDSL Available NOW

- No other vendor ships an IDSL solution: a low cost introduction of xDSL services.
- IDSL is Ascend's technical innovation that leverages existing copper wire and ISDN CPE.
- IDSL supports up to 128 Kbps using the existing local loop (telephone wire, twisted pair).
- IDSL works with existing ISDN BRI Customer Premises Equipment such as terminal adapters and Pipeline® products, and existing IP application software.

Flexibility and Interoperability

- Other DSL modems limit the subscriber's traffic to only one destination that is chosen at installation; Ascend's MultiDSL uses multiple Frame Relay PVCs to allow users to access multiple destinations simultaneously (such as the corporate LAN and the Internet).
- Ascend MultiDSL is the only product that supports a wide range of protocols including Point-to-Point Protocol (PPP), Multilink PPP, (MP), Multilink Protocol Plus™ (MP+), and Frame Relay.

Security

- Ascend is the only vendor to offer fully integrated security with an inspection-based dynamic firewall. Also, customers can use any existing authentication and authorization security such as Ascend Access Control™ (extended RADIUS), RADIUS, TACACS, TACACS+, Token-Cards, PAP, CHAP and MS-CHAP.
- Other DSL modems are totally vulnerable; to secure the user's network would require expensive stand-alone firewalls.

Reliability

- Ascend technology supports a wide range of loopback tests to verify the integrity and quality of the local loop (between Central Office and residence/business sites).
- Ascend is the market leader in ISDN access concentrator ports, and has a proven track record of providing cost-effective solutions – with the most complete feature set at low port prices – for over five years. Ascend has installed over 12,000 MAX™ systems in customer sites worldwide.

Easy Manageability

- Ascend MultiDSL can be managed using NetManage or SNMP.
- Support for the most detailed accounting information available in the industry facilitates billing by minutes or bytes/packets.

Scalability

- The MAX 4002/4004 can support up to 40 IDSL ports.
- The MAX TNT™ can support up to 224 IDSL ports, 240 SDSL ports, and 90 ADSL-CAP ports.

Affordability

- Ascend offers a fully-integrated solution for multiple DSL services, as well as other remote services (such as analog, ISDN, T1/E1, and Frame Relay). With the integrated firewall, the Ascend solution provides low cost, scalable, DSL capabilities with a smooth migration path. Other vendors offer low density, stand-alone modem pools that support one or two DSL services. In order to provide maximum security and performance, the DSL service provided would be forced to invest in multiple systems and add-on pieces (such as firewalls, Ethernet switches, VLANs and Routers)

5. Selling Against the Competition — the Ascend Advantage

Important NOTE: Ascend's strong competitive position

- New market entrants offer DSL modems in pairs – one at the client site and one corresponding at the CO modem bank. These CO modems bridge aggregated Ethernet LANs onto one Ethernet segment, which can result in numerous performance and security problems for the remote access provider.
  - A problem on one subscriber LAN can affect others aggregated to the segment
  - No privacy between LANs
  - Each modem requires its own registered IP address
  - Ascend is the only vendor that delivers (other companies offer) IDSL technology that can leverage existing copper wire and ISDN Customer Premise Equipment
- Ascend is the only vendor with xDSL routers (not bridges) for the CPE.
- Ascend is the only vendor with a true multiservice access concentrator (not Multiplexer) for the CO.
- Ascend is the only vendor with a proven track record in the ISP/carrier remote access market.
- Ascend is the only vendor with a strong market presence in both the access concentrator and CPE marketplace.

Therefore, MultiDSL competitors are all new entrants in the remote access market, and new competitors for Ascend. Ascend's traditional competitors, such as Cisco, 3Com, Shiva, Livingston, and Bay Networks. have not announced their xDSL product strategy beyond statements saying they will provide xDSL support in the future.

Selling Against the Competition

Competition Weaknesses	*The Ascend Advantage*
Alcatel 1000 system	
Designed as an end-to-end solution targeted at telcos only; in this arrangement, telcos need to purchase and own the CPE units	• Ascend's products offer a range of interoperability options for telcos, ISPs and enterprises. IDSL is compatible with existing ISDN routers and TA's, making it an easy, low-cost service to implement immediately.
Not a proven solution; no presence in POPs	• Ascend is the market leader in access concentrator ports, and has a proven track record of providing cost-effective solutions for over three years. Ascend has installed over 12,000 MAX systems in customer sites worldwide. Pipeline products have been shipping for years with a solid field track record.
Not a high-density, multiservice, multiprotocol product – has limited WAN connectivity. Must be paired with the Bay Networks Interface Hub in order to provide OC-3C and T1 connectivity	• Ascend's MAX TNT offers multiprotocol and multiservice (analog, ISDN and xDSL technologies). The MAX line offers a wide range of WAN connectivity (T3, T1, ISDN PRI, ISDN BRI, Frame Relay).
Supports ADSL-DMT only	• With the Pipeline and MAX, Ascend has a fully integrated DSL product line for Central Offices and Customer Premises that includes IDSL, SDSL, HDSL, ADSL-CAP and ADSL-DMT.
CPE is a modem product only, and CO equipment is a multiplexer: products do not provide Layer-3 routing or security features	• Ascend offers fully-integrated security with an inspection-based, dynamic firewall; products can use any existing authentication and authorization security such as Ascend Access Control, RADIUS, TACACS, TACACS+, token cards, PAP, CHAP and MS-CHAP.

Competition Weaknesses	*The Ascend Advantage*
Amati	
Not a proven solution. No market presence in POPs – just released their first access concentrator	• Ascend is the market leader in access concentrator ports, and has a proven track record of providing cost-effective solutions to POPs for over three years. Ascend has installed over 12,000 MAX systems in customer sites worldwide.
Not a high-density, multiservice, multiprotocol product. Unclear as to what WAN connectivity is provided	• Ascend MAX TNT offers multiprotocol and multiservice (analog, ISDN, Frame Relay and xDSL technologies). Provides a wide range of connectivity – analog, ISDN BRI, ISDN PRI, Frame Relay, T1, and T3.
Supports ADSL-DMT only	• With the Pipeline and MAX, Ascend has a fully integrated DSL product line for Central Offices and Customer Premises that includes IDSL, SDSL, HDSL, ADSL-CAP and ADSL-DMT.
CPE is a modem product only, and CO equipment is a multiplexer: products do not provide Layer-3 routing or security features	• Ascend offers IP/IPX routing and fully-integrated security with an inspection-based, dynamic firewall; products can use any existing authentication and authorization security such as Ascend Access Control, RADIUS, TACACS, TACACS+, token cards, PAP, CHAP and MS-CHAP.
Netspeed	
• New company: no market presence or company track record • New product: never manufactured marketed to ISPs/telcos or Consumers	• Ascend is the market leader in access concentrator ports, and has a proven track record of providing cost-effective solutions for over three years. Ascend has installed over 12,000 MAX systems in customer sites worldwide. Pipeline products have been shipping for years with a solid field track record.
CPE is a modem product only, and CO equipment is a multiplexer: products do not provide Layer-3 routing or security features	• Ascend offers IP/IPX routing and fully-integrated security with an inspection-based firewall; products can use any existing authentication and authorization security such as Ascend Access Control, RADIUS, TACACS, TACACS+, token cards, PAP, CHAP and MS-CHAP.

Competition Weaknesses	*The Ascend Advantage*
Orckit	
Modem manufacturer only – not an end-to-end solution at this time. Has promised to provide modem banks for the CO in the future	• Ascend has a complete MultiDSL end-to-end, scalable solution for a range of subscribers and high-density service providers.
CPE is a modem product only: no routing or security features	• Ascend offers IP/IPX routing and fully-integrated security with an inspection-based, dynamic firewall; products can use any existing authentication and authorization security such as Ascend Access Control, RADIUS, TACACS, TACACS+, token cards, PAP, CHAP and MS-CHAP.
PairGain	
New, unproved product line of ADSL-CAP modems just released	• No ISDN or ADSL-DMT at this time. No lower cost options. Pipeline products have been shipping for years with a solid field track record.
New entrant in the CO market. DSLAM has low density and limited scalability; provides T1 connectivity only, via an additional purchase of their access gateway.	• Ascend is the market leader in Access Concentrator Ports, and has a proven track record of providing cost-effective solutions to the POP for over three years. The MAX scales up to 672 ports and provides a range of WAN connectivity – analog, ISDN BRI, ISDN PRI, Frame Relay, T1, and T3.
CPE is a modem product only, and CO equipment is – multiplexer: products do not provide Layer 3 routing or security features	• Ascend offers IP/IPX routing and fully-integrated security with an inspection-based, dynamic firewall; products can use any existing authentication and authorization security such as Ascend Access Control, RADIUS, TACACS, TACACS+, token cards, PAP, CHAP and MS-CHAP.

Competition Weaknesses	*The Ascend Advantage*
Paradyne	
Not a proven access concentrator; no presence in POPs	• Ascend is the market leader in access concentrator ports, and has a proven track record of providing cost-effective solutions to POPs for over three years. Ascend has installed over 12,000 MAX systems in customer sites worldwide.
Not a high-density, multiservice, multiprotocol product; WAN connectivity is limited to T1/E1	• Ascend MAX TNT offers multiprotocol and multiservice (analog, ISDN, Frame Relay and xDSL technologies). Provides a wide range of connectivity – analog, ISDN BRI, ISDN PRI, Frame Relay, T1, and T3.
Supports ADSL-CAP and SDSL/HDSL only	• With the Pipeline and MAX, Ascend has a fully integrated DSL product line for Central Offices and Customer Premises that includes IDSL, SDSL, HDSL, ADSL-CAP and ADSL-DMT.
CPE is a modem product only, and CO equipment is a multiplexer: products do not provide Layer-3 routing or security features	• Ascend offers IP/IPX routing and fully-integrated security with an inspection-based, dynamic firewall; products can use any existing authentication and authorization security such as Ascend Access Control, RADIUS, TACACS, TACACS+, token cards, PAP, CHAP and MS-CHAP.
SourceCom	
Not an end-to-end solution; provides one CO product only	• Ascend has a complete MultiDSL end-to-end, scalable solution for a range of subscribers and high-density service providers.
Not proven in the ISP/Carrier POP	• Ascend is the market leader in access concentrator ports, and has a proven track record of providing cost-effective solutions to POPs for over three years. Ascend has installed over 12,000 MAX systems in customer sites worldwide.
Not a multiprotocol product: has limited WAN connectivity	• Ascend's MAX TNT is a multiprotocol solution with T1/E1, PRI, and Frame Relay – connectivity.
A multiplexer only: no routing or security features	• Ascend offers fully-integrated security with an inspection-based, dynamic firewall; products can use any existing authentication and authorization security such as Ascend Access Control, RADIUS, TACACS, TACACS+, token cards, PAP, CHAP and MS-CHAP.

Competition Weaknesses	*The Ascend Advantage*
US Robotics Supports ADSL-CAP only	• Ascend has a complete MultiDSL end-to-end, scalable solution for a range of subscribers and high-density service providers.
CO product is low density and lacks management and security features	• Ascend offers a high-density solution with fully-integrated, dynamic security, extended RADIUS capabilities, and bandwidth management capabilities such as GRE tunneling and Multichassis MP/MP+.
Westell Supports ADSL-CAP only	• Ascend has a complete MultiDSL end-to-end, scalable solution for a range of subscribers and high-density service providers.
Not a high-density, multiservice, multiprotocol product; WAN connectivity is limited to ATM only	• Ascend's MAX TNT is a multiprotocol solution with T1/E1, PRI and Frame Relay connectivity.
CPE is a modem product only, and CO equipment is a multiplexer: products do not provide Layer-3 routing or security features	• Ascend offers IP/IPX routing and fully-integrated security with an inspection-based, dynamic firewall; products can use any existing authentication and authorization security such as Ascend Access Control, RADIUS, TACACS, TACACS+, token cards, PAP, CHAP and MS-CHAP.

6. Other Competitive Reference Documents

For further information, please refer to the following documents:

1. *Ascend Pipeline Product Line vs. Key Competitors (Competitive Bulletin, December 1996)
2. *MAX 400X competitive analysis documents
3. Comparison of High End Access Concentrators
4. *MultiDSL Competitive Analysis (November 1996)

** available on the Competitive Marketing Intranet Web page*

Any feedback or suggestions are welcome. Please send any pertinent competitive information to the attention of the Competitive Marketing group in Alameda (x2081)

7. Appendix

xDSL Client Modem Competitive Matrix

	Ascend Pipeline/NetWarp	Ascend DSLPipe-S	Ascend DSLPipe-C	Ascend DSLPipe-D	Alcatel 1000	Amati Overture 8
Service	IDSL	SDSL	ADSL-CAP	ADSL-DMT	ADSL-DMT	ADSL-DMT
Bandwidth						
Downstream	128 Kbps	768 Kbps	1.5-6.1 Mbps	1.5-6.1 Mbps	1.5-6.1 Mbps	1.5-8
Upstream	128 Kbps	768 Kbps	64-640 Kbps	176-640 Kbps	176-640 Kbps	640 Kbps
Price (MSRP)	$229-2995	$1,495	$1,795	TBD	$500/line	$2,500
Key Features						
Bridging	Yes	Yes	Yes	Yes	NO	NO
IP Routing	Yes	Yes	Yes	Yes	Yes	NO
IPX Routing	Yes	Yes	Yes	Yes	NO	NO
Multi-User	Yes	Yes	Yes	Yes	Yes	NO
SNMP Support	Yes	Yes	Yes	Yes	Yes	NO
Security	Yes	Yes	Yes	Yes	NO	NO
Dynamic Firewall	Optional	Optional	Optional	Yes	NO	NO

xDSL Client Modem Competitive Matrix – cont'd

	NetSpeed SpeedRunner 100	NetSpeed SpeedRunner 200	Orckit ORcom	Orckit ORsingle	Orckit ORVision	PairGain MegaBit 768	PairGain EtherPhone
Service	ADSL-CAP	ADSL-CAP	HDSL	SDSL	ADSL-DMT	HDSL	HDSL
Bandwidth							
Downstream	1-2 Mbps	8 Mbps	2 Mbps	2 Mbps	to 8.2 Mbps	768 Kbps	768 Kbps
Upstream	1 Mbps	1 Mbps	2 Mbps	2 Mbps	to 640 Kbps	768 Kbps	768 Kbps
Price (MSRP)	$1,295	$1,695	$1500-2500/ line[1]	$1500-2500/ line[1]	$1500-2500/ line[1]	$795-1695	$795-1395
Key Features							
Bridging	Yes	Yes	NO	NO	NO	Yes	Yes
IP Routing	Yes	Yes	NO	NO	NO	NO	NO
IPX Routing	Yes	Yes	NO	NO	NO	NO	NO
Multi-User	NO	NO	NO	NO	NO	NO	NO
SNMP Support	Yes	Yes	NO	NO	NO	Yes	Yes
Security	NO	NO	NO	NO	NO	NO	NO
Dynamic Firewall	NO	NO	NO	NO	NO	NO	NO

xDSL Client Modem Competitive Matrix – cont'd

	PairGain Megabit HRA	PairGain Megabit CRA	PairGain Megabit c1500	Paradyne HotWire 5100	USR Viper	Westell FlexCAP	Westell InterAccess	Westell Supervision
Service	RA-HDSL	RA-ADSL-CAP	ADSL-CAP	ADSL-CAP	RADSL-CAP	ADSL-CAP	HDSL	RA-ADSL-CAP
Bandwidth								
Downstream	1 Mbps	2.5 Mbps	1.6 Mbps	640 Kbps-2.5 Mbps	1.5 Mbps	1.5 Mbps	2.05Mbps	640 Kbps-8 Mbps
Upstream	1 Mbps	1 Mbps	64 Kbps	272 Kbps-1 Mbps	384Kbps	64 Kbps	2.05 Mbps	272 Kbps-1 Mbps
Price (MSRP)	$1,195	$1,295	$1,595	not available	$545	$1200-1500/line[1]	$1200-1500/line[1]	$1200-1500/line[1]
Key Features								
Bridging	Yes	Yes	Yes	NO	Yes	NO	NO	NO
IP Routing	NO	NO	NO	NO	Yes	NO	NO	NO
IPX Routing	NO	NO	NO	NO	Yes	NO	NO	NO
Multi-User	NO	NO	NO	NO	NO	NO	NO	NO
SNMP Support	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Security	NO	NO	NO	NO	Yes	NO	NO	NO
Dynamic Firewall	NO	NO	NO	NO	NO	NO	NO	NO

[1]Marketed to the telco as an end-to-end subscriber line solution; prices per unit are not available

Comparison of xDSL Access Concentrators

Feature	MAX 400X	MAX TNT	Alcatel A1000	Amati Allegro	Netspeed LoopRunner
Service Support	IDSL	IDSL, SDSL, ADSL	ADSL (DSLAM*)	ADSL-DMT (DSLAM*)	ADSL (DSLAM*)
List Price					
Chassis	$11,000-$15,500	$18,750	[1]not available	[1]not available	[1]not available
Maximum ports/unit	40	ports/shelf: 224-IDSL 240-SDSL 90-ADSL-CAP		48	419 Ethernet ports
Ports/card	8	32-IDSL 16-SDSL 6-ADSL-CAP		12	6/modem
Price/ modem card	$3,000	$4,200-IDSL $8,500-SDSL $8,250-ADSL			
Price/modem	$375	$350-IDSL $531-SDSL $1,375-ADSL			$200-500
WAN Connectivity					
	T1, V.34, ISDN BRI, ISDN PRI, Frame Relay	T1, V.34, PRI Frame Relay	ATM OC-3c, Frame Relay	ATM OC-3c	T1, V.34, ISDN BRI, ISDN PRI, Frame Relay
Bandwidth Management					
	MP, MP+, Hardware Data Compression, Multi-Chassis MP/MP+	MP, MP+, Hardware Data Compression, Multi-Chassis MP/MP+	unknown	unknown unknown	Data compression
Security					
	PAP/CHAP, TACACS & TACACS+, Integrated Dynamic Firewall, Extended RADIUS	PAP/CHAP, TACACS & TACACS+, Integrated Dynamic Firewall, Extended RADIUS	none	none	none
Routing Protocols					
	IP, IPX, OSPF, RIP2	IP, IPX, OSPF, RIP 2	none	none	IP

Comparison of XDSL Access Concentrators cont'd

Feature	PairGain Access Hub and Gateway	Paradyne HotWire 8500	SourceCom Banc6000	US Robotics Total Control AXCell	Westell Supervision Multiplexer
Service Support	xDSL (DSLAM*)	xDSL (DSLAM*)	xDSL (DSLAM*)	RADSL-CAP	ADSL-CAP modem bank plus multiplexer*
List Price					
Chassis	$2295	not available	not available	$47,113	[1]not available
Maximum ports/unit	146 Ethernet ports	576 Ethernet ports	1024 Ethernet ports (32 units)	32	
Ports	14 Ethernet ports	72 Ethernet port/shelf	32 Ethernet ports/unit	16 dual port cards/chassis	
Price/modem card				$875/card	
Price/modem	not available	$950-$1,500	$700-1000	$388/port	
WAN Connectivity					
	V.34	Frame Relay	T1	T1, ISDN PRI, Frame Relay	ATM OC-3
Bandwidth Management					
	none	none	none	MP	none
Security					
	none	none	none	static firewall	none
Routed/Routing Protocol Support	IP	IP	none	IP/IPX	none

[1]Marketed to the telco as an end-to-end subscriber line solution; prices per unit are not available

** Important NOTE: DSLAMs are multiplexers, not multiservice concentrators with routing capabilities*

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