

Competitive Marketing Information

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- Competitor Strengths and Weaknesses- Company Level Analysis
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- Competitor Attacks on Ascend
- Detailed MAX™ Competitive Product Review / Analysis
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**Competitive Marketing Group
December 1997**

Competitive Environment



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Summary: Ascend's Major Competitors by Product Segment

Remote Access Telecommuter (Pipeline)

3Com

Cisco

Bay Networks

Shiva

Motorola

WAN Remote Access Switch (MAX, TNT)

3Com/USR

Cisco

Shiva/Nortel

Livingston/Lucent

Bay Networks



Summary: Ascend's Major Competitors by Product Segment

Multimedia

AdTran
Promptus
Madge Networks

Backbone Switches

Cisco
Ipsilon, Torrent
Newbridge
Nortel
Lucent
Yurie Systems



In Q2'97, Ascend Dominated the Worldwide Remote Access Market

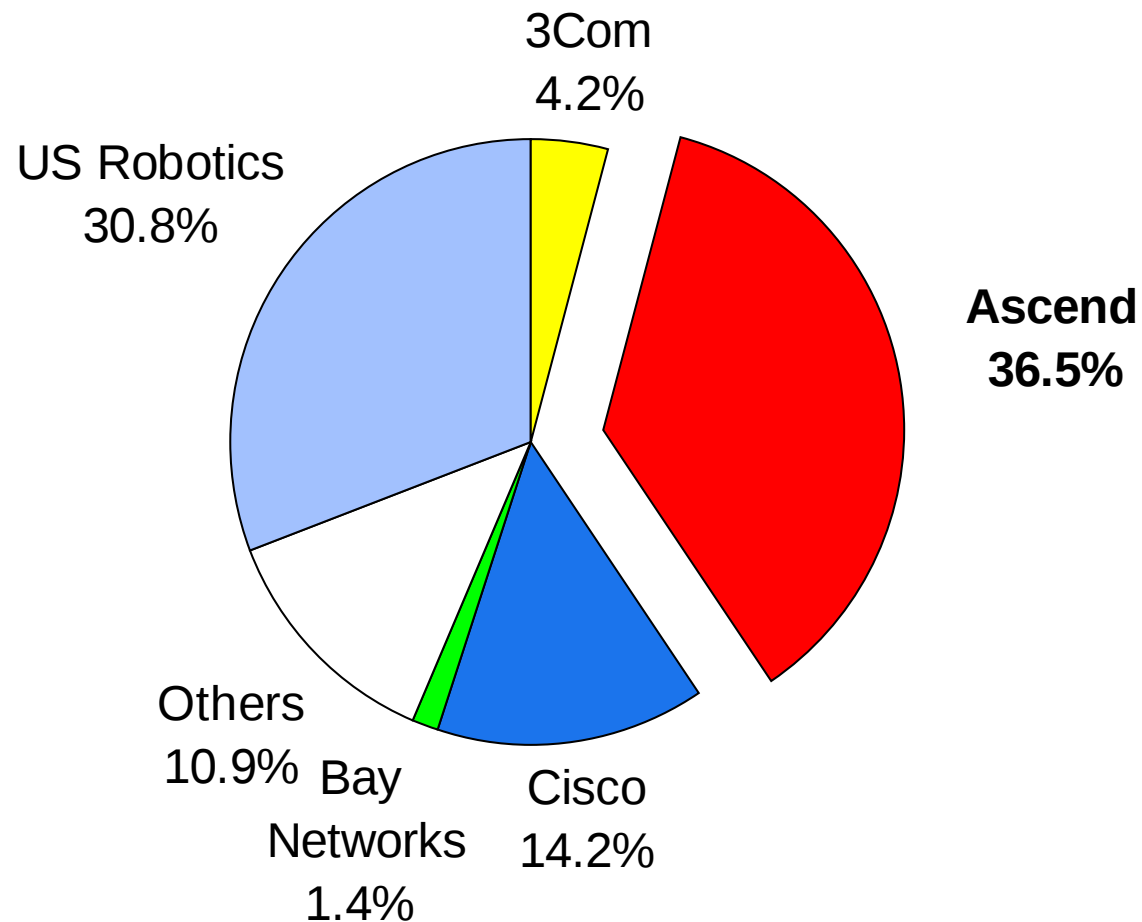
- **Ascend is the undisputed leader in the access concentrator market in terms of revenues and port shipments**
 - ◆ 36.5% of total worldwide manufacturing revenues
 - ◆ 50.6% of total worldwide analog ports
 - ◆ 62.2% of total worldwide ISDN PRI ports
 - ◆ 33.6% of total worldwide T1s
- **Maintains an 8.8% share of the shrinking access server market**
- **Has 11.8% share of the competitive ISDN SOHO router market**



Ascend is the Leader in Worldwide Access Concentrator Revenues

Worldwide Market Share of Total Remote Access Concentrator Revenues

Based on Q2'97 Shipments



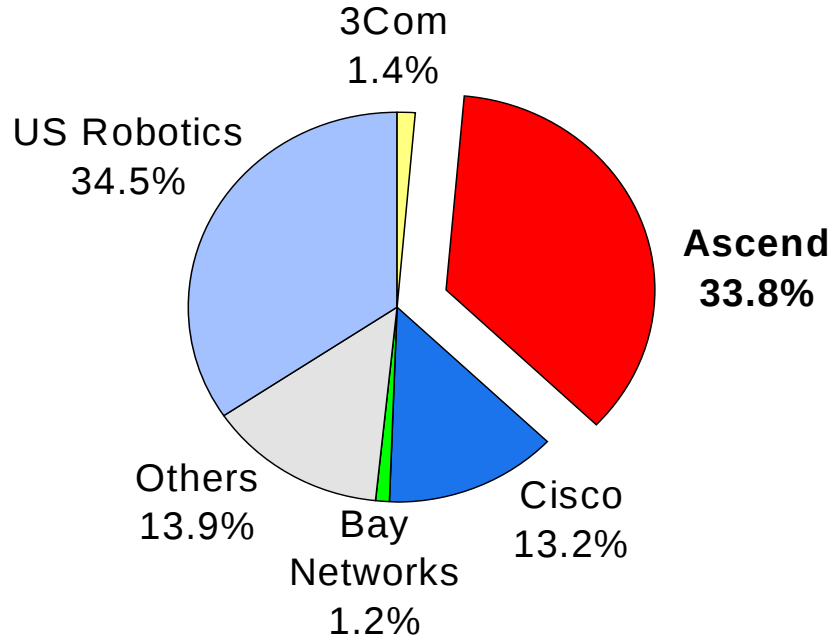
Source: Dell'Oro Group, 8/97



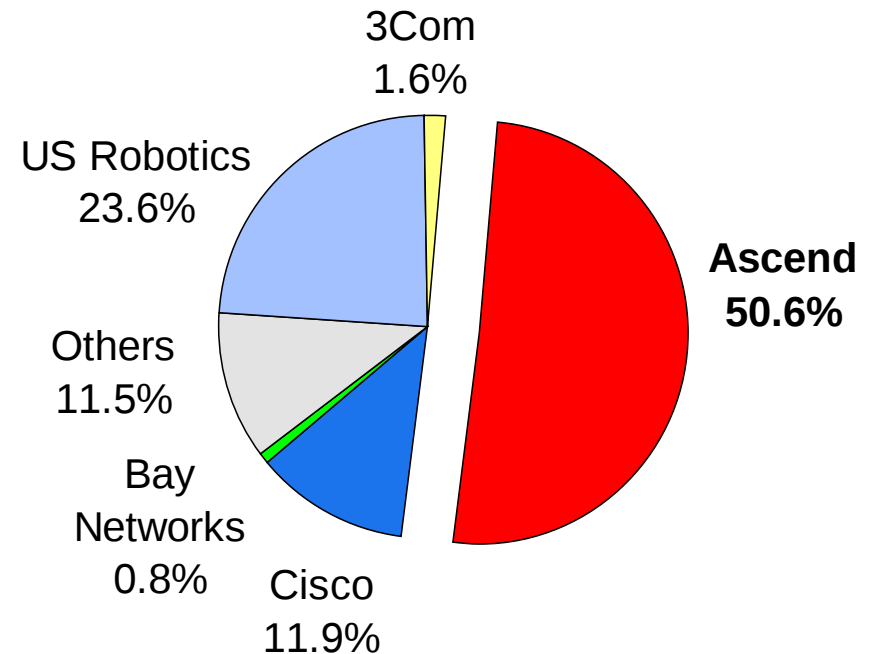
Ascend Gained Significant Analog Port Share in the Remote Access Concentrator Market In Q2'97

Change in Worldwide Market Share of Total Analog Remote Access Concentrator Ports: Q1'97 to Q2'97

Q1'97 port shipments



Q2'97 port shipments

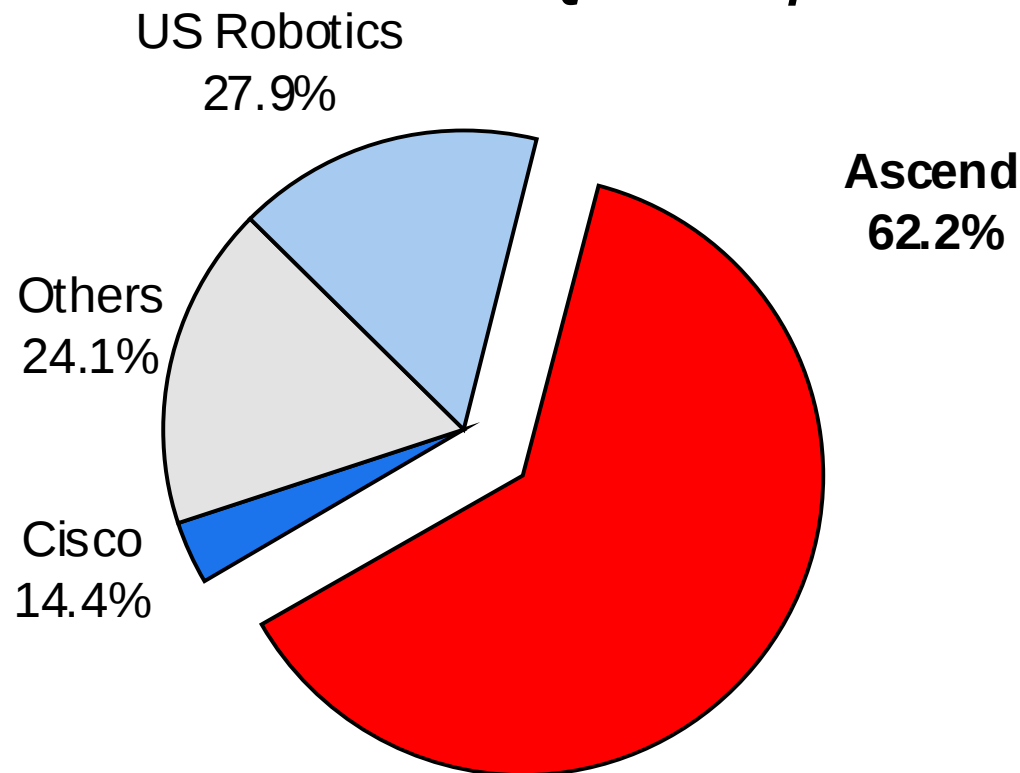




Ascend Dominates Access Concentrator ISDN PRI Ports

**Worldwide Market Share of Total Remote Access Concentrator
ISDN PRI Ports (B-channels)***

Based on Q2'97 Shipments



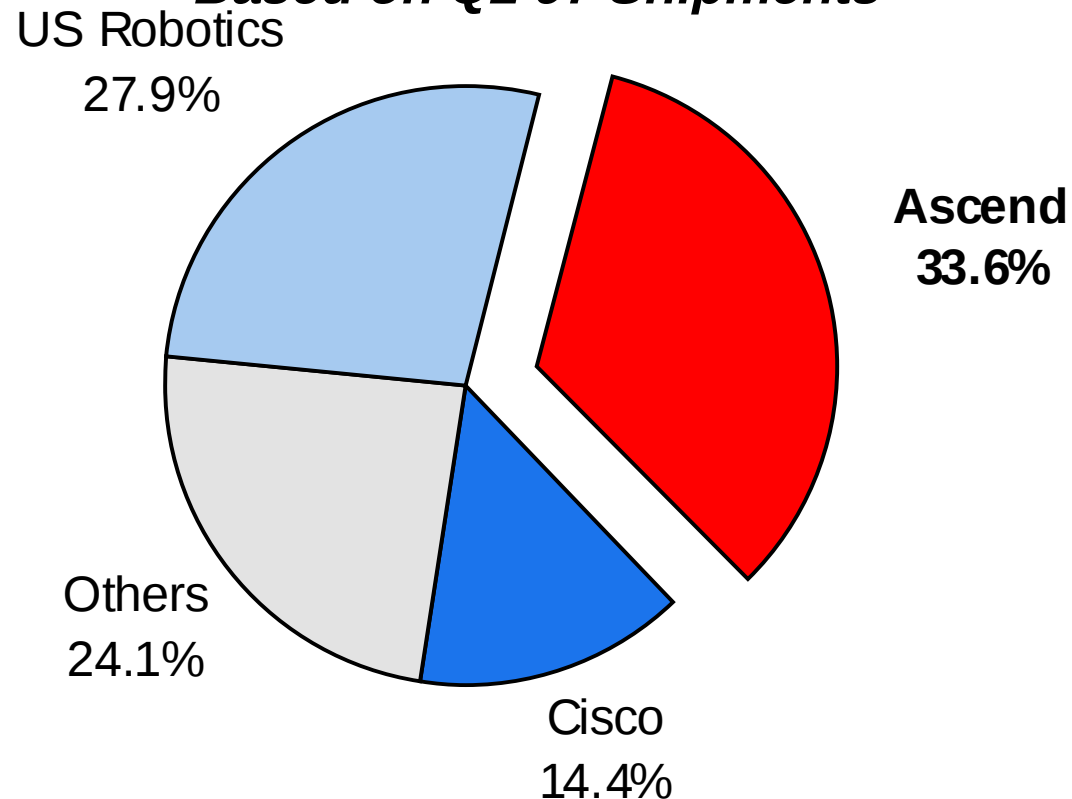
*** In Q2'97, the Dell'Oro Group began separating ISDN PRI ports from T1 ports, therefore, comparative charts are not available**



Ascend Leads in Access Concentrator T1 Ports

Worldwide Market Share of Total Remote Access
Concentrator T1 DS-0s*

Based on Q2'97 Shipments



* In Q2'97, the Dell'Oro Group began separating ISDN PRI ports from T1 ports, therefore, comparative charts are not available

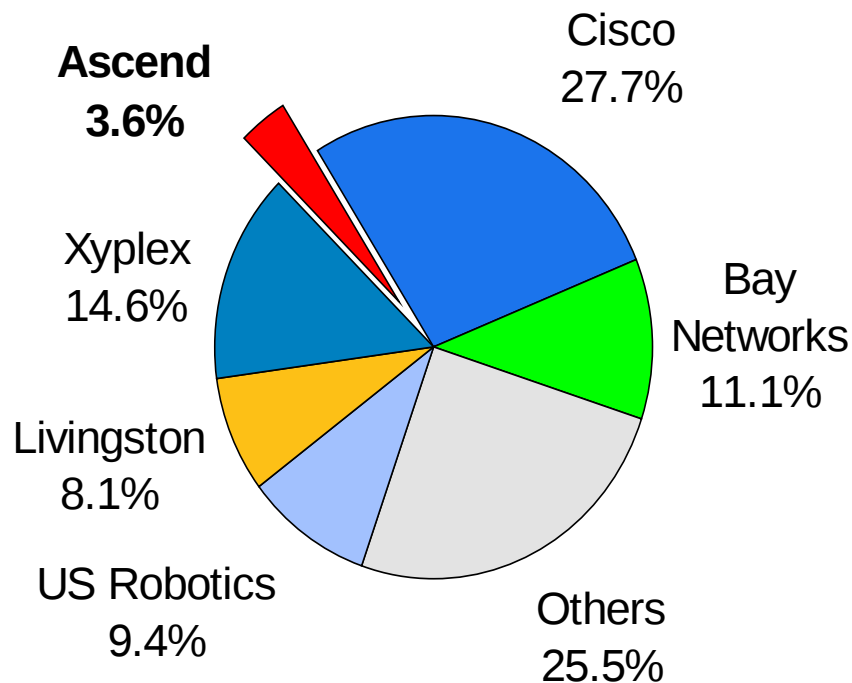
Source: Dell'Oro Group, 8/97



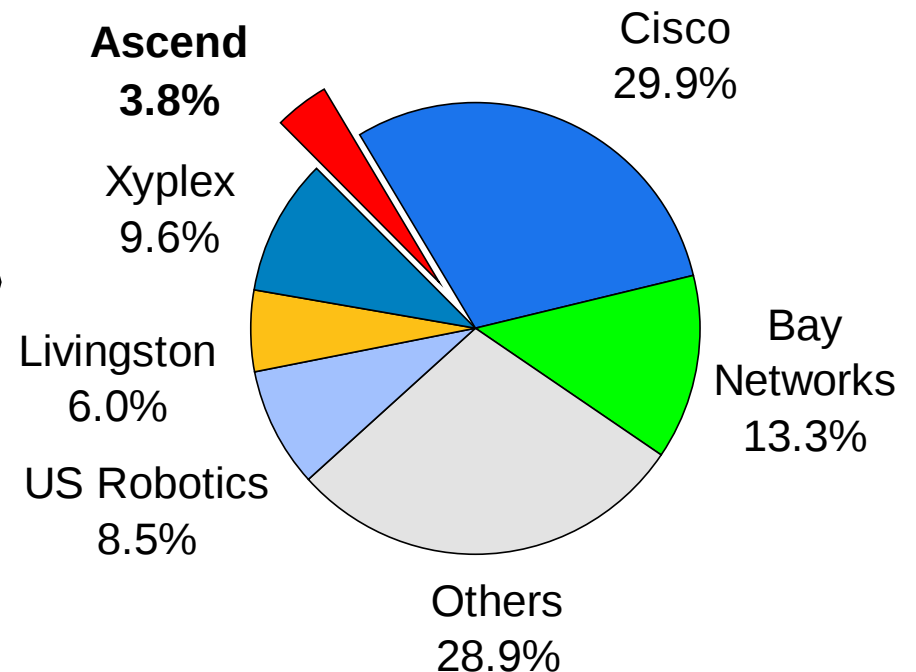
Ascend's Share of the Remote Access Server Market

Change in Worldwide Market Share of Total Remote Access Server Ports: Q1'97 to Q2'97

Q1'97 port shipments



Q2'97 port shipments



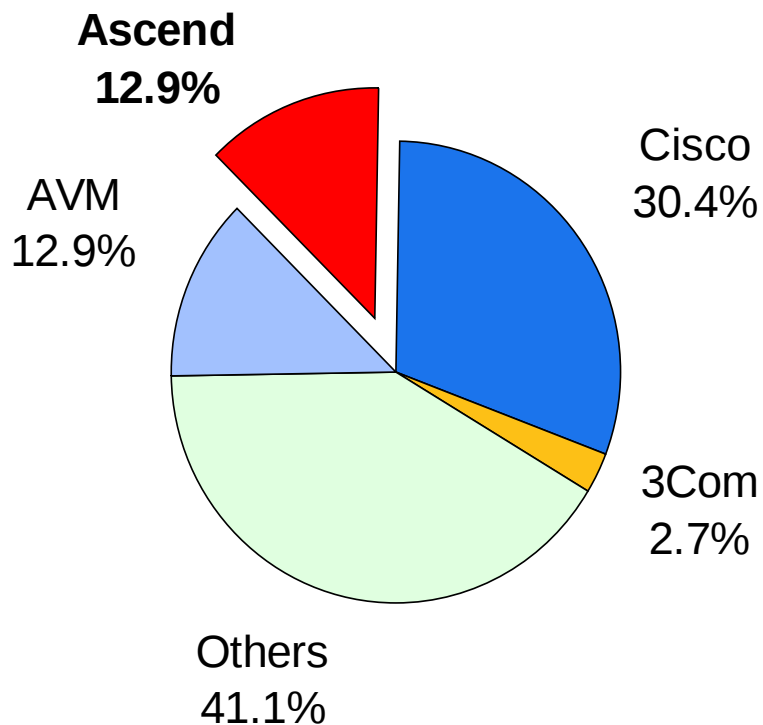
Source: Dell'Oro Group, 8/97

Ascend's Share of the Crowded SOHO Router Market

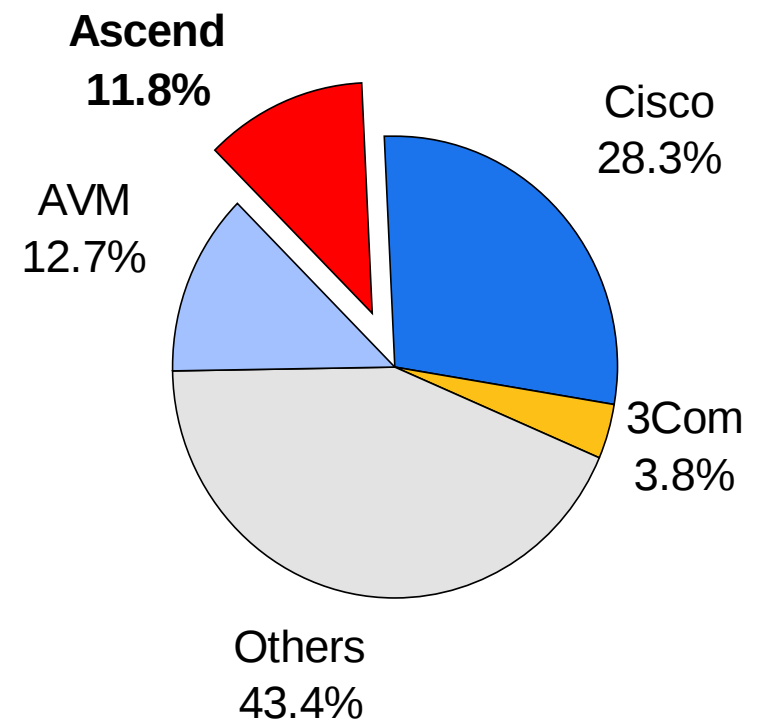


Change in Worldwide Market Share of SOHO Router Ports: Q1'97 to Q2'97

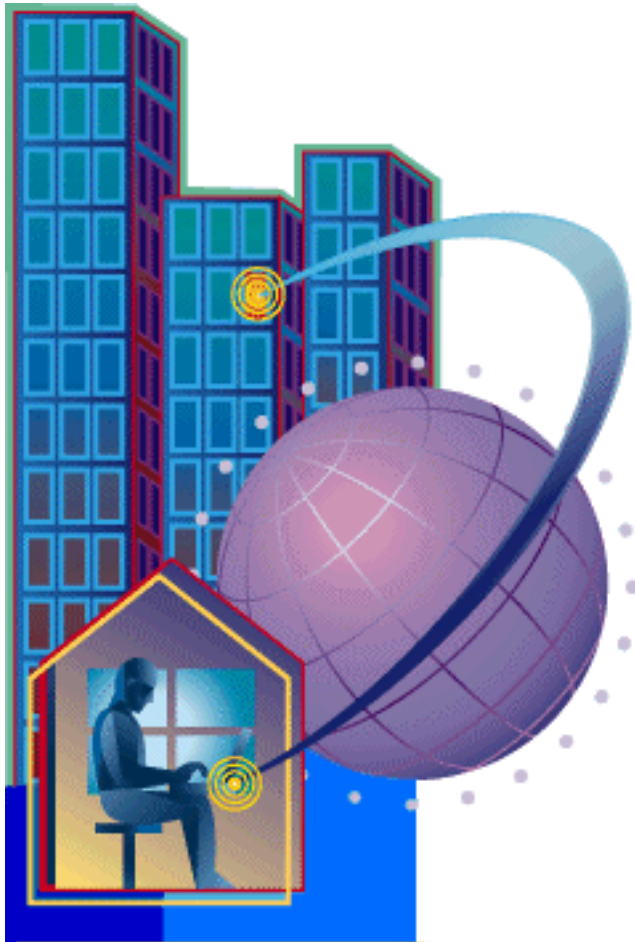
Q1'97 port shipments



Q2'97 port shipments



Source: Dell'Oro Group, 8/97



Competitor Strengths & Weaknesses

- Company Level Analysis

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Cisco Systems: Problematic Technical Integration and Field Performance

Strengths

- ◆ Largest installed base of backbone routers and switches; viewed as a strategic vendor
- ◆ Complete line of LAN-to-WAN solutions
- ◆ Customer mindshare (“brand awareness”)
- ◆ Strong direct sales force and good market penetration

Weaknesses

- ◆ Loosely integrated product lines because of technologies acquired from different companies
- ◆ Router-centric; business model evolves around backbone router products
- ◆ Limited ISP market presence (access routers, BB switches)
- ◆ Late to market with high-end remote access products
- ◆ Late to market with gigabit switch/router
- ◆ Poor network management



US Robotics: Struggling with 3Com Acquisition and Modem-Centric Legacy

Strengths

- ◆ Leader in modem technology
- ◆ Good ISP market presence with analog modems
- ◆ Leadership in client analog modems
- ◆ Strong distribution channels/strong retail

Weaknesses

- ◆ Confusion/distraction with 3Com merger
- ◆ Proprietary stance on 56K technology
- ◆ High priced product lines in the access segment until now
- ◆ Late with ISDN integration
- ◆ Introducing new, unproven routing technology
- ◆ Focus skewed towards low-end product lines (modems)



Livingston: Not a Scalable, Carrier Class Product Line

Strengths

- ◆ Competitive pricing
- ◆ Good presence in small-medium-size ISPs

Weaknesses

- ◆ Small, undercapitalized company
- ◆ No Carrier Class products
- ◆ Late to market with high speed WAN connectivity



Shiva: No ISP/Carrier Class Products

Strengths

- ◆ Large installed base of client software
- ◆ Aggressive marketing
- ◆ Good penetration into Corporate Accounts : departmental access servers

Weaknesses

- ◆ Very limited ISP and Carrier market presence
- ◆ Just announced high density, Carrier Class solution
- ◆ Late entry with access concentrator products
- ◆ OEM dependency to accelerate sales
 - ◆ Nortel
- ◆ No proven ISDN technology
- ◆ Diminishing market share



Key Feature Comparison by Product

- Comparative Matrices

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Pipeline 25-Fx/50/75 Vs. Other SOHO ISDN Routers

Ascend's Pipeline: More choices to fit various user needs at a lower cost

	Pipeline 25-Fx	Pipeline 50	Pipeline 75	Cisco 766	Cisco 1004	Shiva Access Port
Price range	\$595	\$895- \$1,395	\$995- \$1,495	\$799- \$1,099	\$1,400	\$995- \$1,495
Protocols routed	Bridge only	IP/IPX	IP/IPX	IP/IPX	IP/IPX (added cost)	IP/IPX
Analog lines	2	0	2	2	0	2
Multi-user	4	Yes	Yes	Yes (additional cost over 4)	Yes	Yes
Network Address Translation	Yes	Yes	Yes	Yes	No	No
Dynamic firewall	No	Optional	Optional	No	No	No
Token-based security	Yes	Yes	Yes	No	No	No

MAX Family Vs. Other Access Concentrators



Ascend's MAX: Complete scalability, bandwidth management and integrated security at a lower cost

	MAX 20XX	MAX 40XX	Cisco AS5X00	Livingston PM3	Shiva LanRover AS	USR Total Control
Max modems/ Unit	12-24	8-96	48/96	48	72	48
Price/modem	\$580-700	\$542-750	\$468	\$639	\$724	\$920
WAN protocol support	T1/E1, ISDN BRI/PRI, Frame Relay	T1/E1, ISDN BRI/PRI, Frame Relay	T1/E1, ISDN PRI, Frame Relay	T1, ISDN PRI, Frame Relay	T1/E1, ISDN PRI	T1/E1, ISDN PRI, Frame Relay
Protocol support	IP, IPX, AppleTalk, OSPF, RIP2, RSVP (Q3'97)	IP, IPX, AppleTalk, OSPF, RIP2, RSVP (Q3'97)	IP, IPX, AppleTalk, OSPF, RIP2	IP, IPX, OSPF	IP, IPX, AppleTalk, OSPF, RIP2	IP, IPX
Security	Dynamic integrated firewall, encryption	Dynamic integrated firewall, encryption	Static firewall, encryption	Static firewall	Static firewall	Static firewall
Bandwidth management	MP, MP+, Multichassis MP/MP+	MP, MP+, Multichassis MP/MP+	MP, Multichassis MP	MP, Multichassis MP	MP	MP
STAC compression	Hardware	Hardware	Software	Software	Software	Software
56Kbps Support	Yes	Yes	Yes (Summer '97)	Yes	Yes (Summer '97)	Proprietary x2
XDSL Support	No	Yes	Yes (IDSL promised)	No	No	Yes-RADSL

MAX TNT Vs. Other Carrier Class Access Concentrators



Ascend's MAX TNT: Lower cost, with T3/Channelized T3 WAN interface and Multiprotocol support

	MAX TNT	Bay MSX 5399	Cisco AS5X00	Nortel Rapport 670 (Shiva)	USR Total Control Hub (current)	USR Total Control Hub (planned*)
Pricing						
- Base chassis	\$18,750	\$4,495	\$15,285	\$16,400	\$5,490	\$5,490
- Fully configured shelf	\$200,750	\$249,500	\$36,300	\$65,300	\$44,126	\$176,000
- Per modem port	\$697	\$433	\$468	\$1,360	\$919	\$525
- Per B-channel	\$522	\$433	\$468	\$1,020	\$460	\$525
Analog Ports						
- Per shelf	288	576	48/96	48	48	336
- Per Telco rack	2,016	2,304	1,000+	288	288	2,016
ISDN ports						
- Per shelf	672	576	48/96	64	230	336
- Per Telco rack	4,032	2,304	1,000+	384	1,380	2,016

* expected in late summer 1997 but not announced



MAX TNT Vs. Other Carrier Class Access Concentrators (cont.)

Ascend's MAX TNT: Lower cost, with T3/Channelized T3 WAN interface and Multiprotocol support

	MAX TNT	Bay MSX 5399	Cisco AS5300	Nortel Rapport 670(Shiva)	USR Total Control Hub (current)	USR Total Control Hub (planned*)
LAN connectivity	10/100Base-T FDDI HSSI (6/97)	10/100BaseT	10/100Base-T	10Base-T, FDDI	10Base-T, Token Ring	10/100Base-T ATM (promised)
WAN connectivity	ISDN PRI, T1/E1, Channelized T1/E1,T3, Channelized T3, Frame Relay	ISDN PRI, Channelized T1/E1	ISDN PRI, T1/E1, Frame Relay	ISDN PRI, T1/E1, ATM T3 or OC-3, Frame Relay	ISDN PRI, T1/E1 Frame Relay	ISDN PRI, T1/E1 Frame Relay
Protocol support	IP, IPX, AppleTalk, OSPF, RIP2, IP Multicast	IP, IPX, AppleTalk, RIP2	IP, IPX, AppleTalk, OSPF, RIP2, IP Multicast	IP, IPX, AppleTalk, OSPF, RIP1	IP, IPX	IP, IPX
Backplane Speed	229 Mbps	no claims	no claims	149 Mbps	no claims	no claims
High-speed modum support	K56Flex, IDSL	K56Flex	K56Flex, IDSL	none	x2; RADSL (Q2'97)	x2, RADSL

Ascend



Ascend Key Competitive Advantages

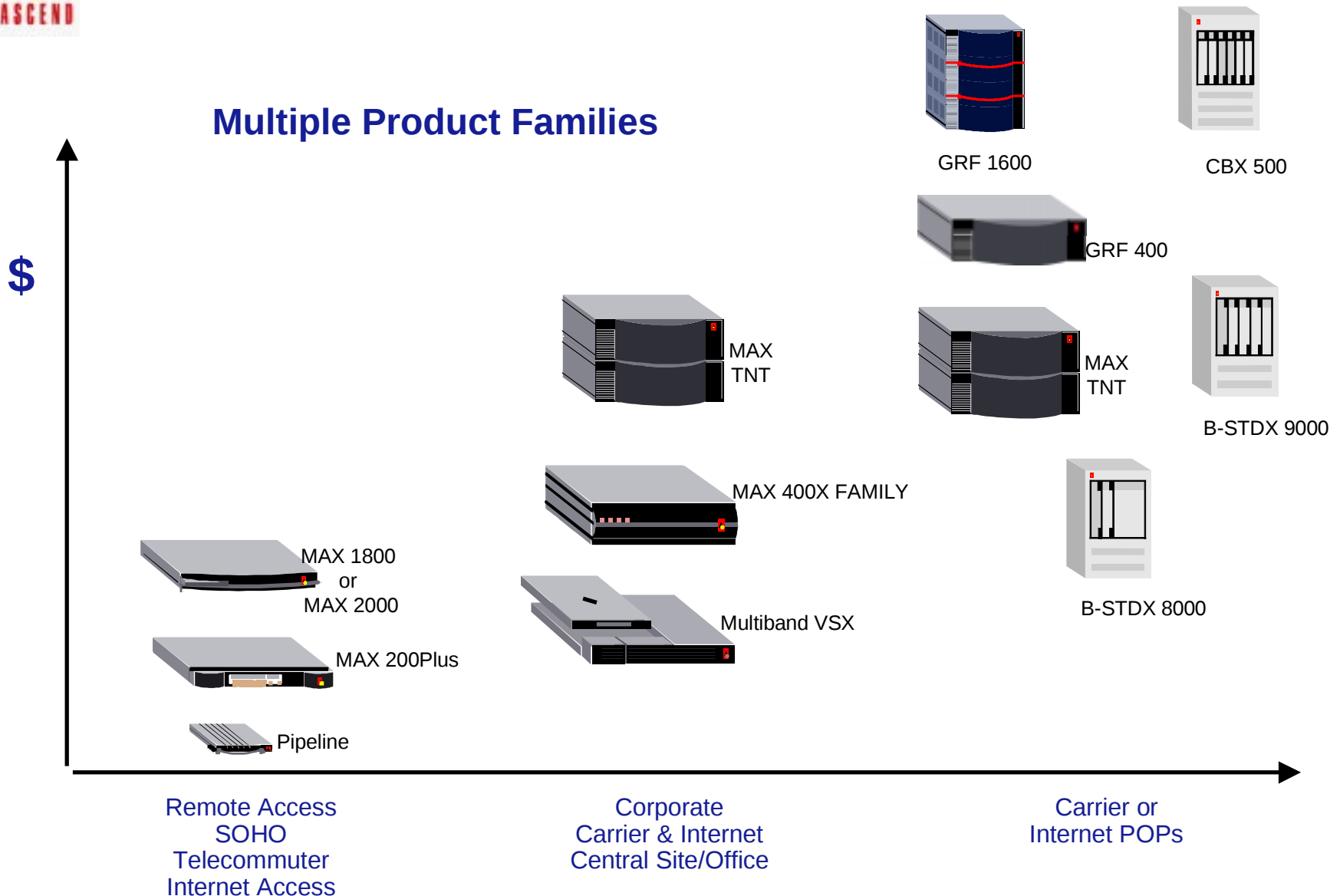
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Ascend Competitive Advantage #1: End to End Solution

Multiple Product Families



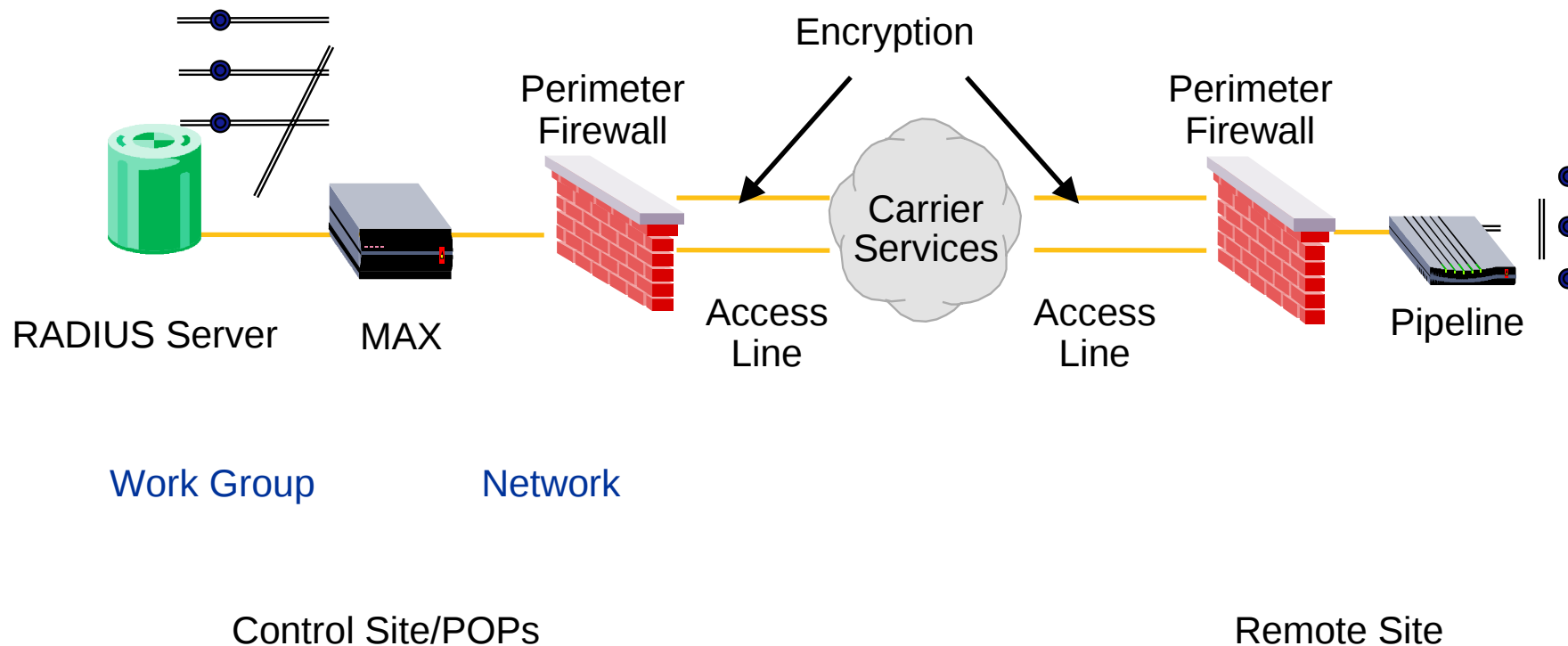


Ascend Competitive Advantage #2: Field Proven Software/Hardware

- Over 3.5 Million ISDN Ports Shipped
- Over 2.5 Million Digital Modems Shipped
- Over 3 Million Lines of Field-Proven Software
- Enhanced Authentication and Security
 - Over 120 Radius Extensions
- Comprehensive WAN Technology
- Internationalized in Over 36 Countries
- Ease of Use
- Highest Port Density per Cubic Inch
- Multi-protocol Support
- Carrier-class Products
- End-to-end Security With Authentication, Encryption and Firewall in One Package
- Bandwidth on Demand



Ascend Competitive Advantage #3: Integrated Security





Ascend Competitive Advantage #4: Scalable Density, Lower Price

	MAX	MAX TNT	Cisco	Livingston	Shiva	USR
Number of B-channels/system	12-96	672	48/96	48	78	230-336
Number of analog ports/system	12-72	672	48/96	48	48	48-336
Price/Modem Port	\$542-750	\$683	\$468	\$639	\$1,125	\$525-\$920

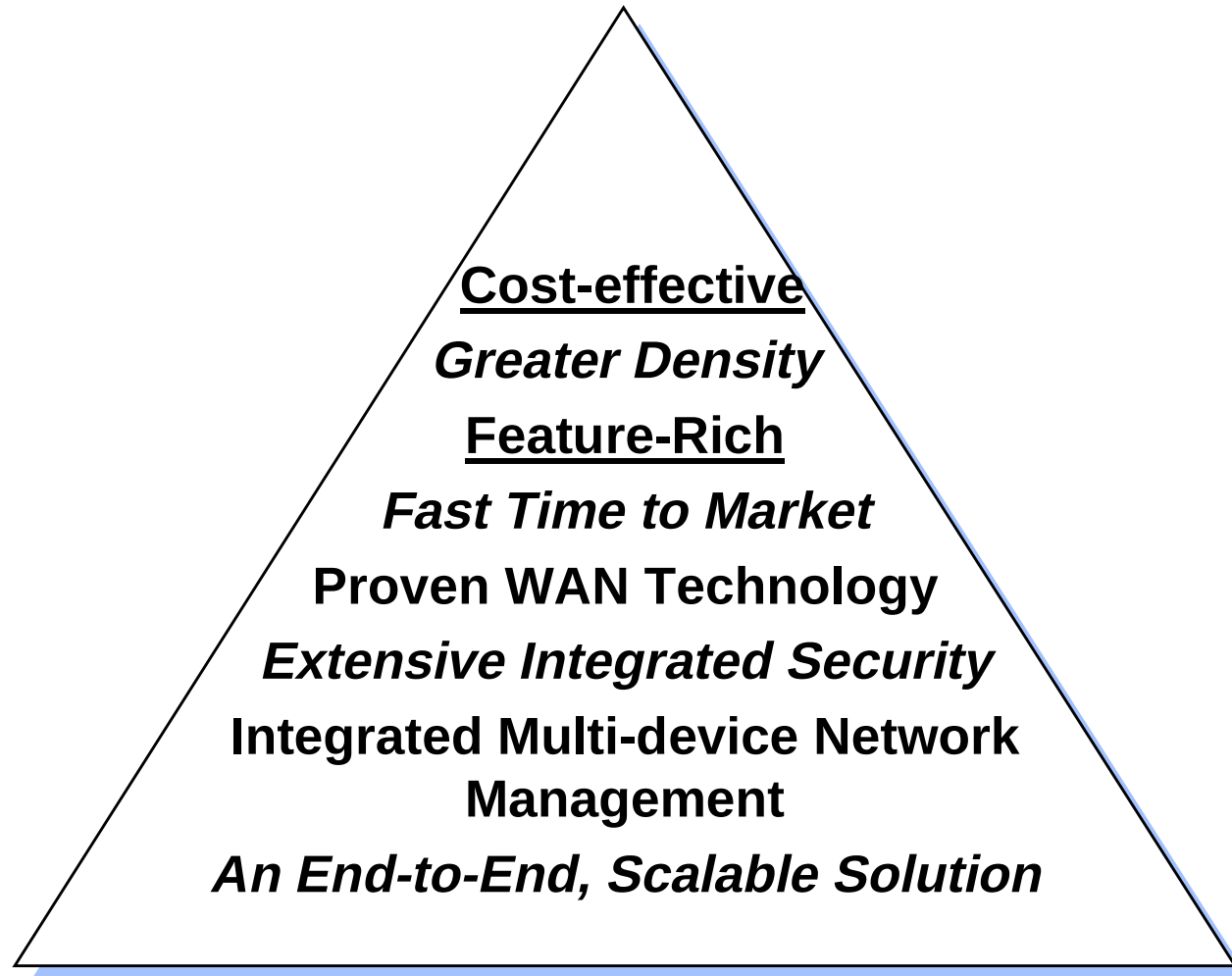


Ascend Advantage #5: Best of Class Security and Network Management

	MAX	MAX TNT	Cisco	Livingston	Shiva	USR
Security						
Extended RADIUS	Yes	Yes	No	No	No	No
TACACS/TACACS+	Yes	Yes	Yes	Yes	No	Yes
Integrated Firewall	Yes	Yes	No	No	Yes	No
VPN Support	Yes	Yes	Yes	No	Yes	Yes
Encryption	Yes	Yes	Yes	No	No	No
Network Management						
Total POP Management	Yes	Yes	No	No	No	No
Multivendor Router/Switch Support	Yes	Yes	No	No	No	No
Complete Discovery/ Mapping	Yes	Yes	No	No	No	No
QoS Reporting	Yes	Yes	No	No	No	No



The Ascend Advantage





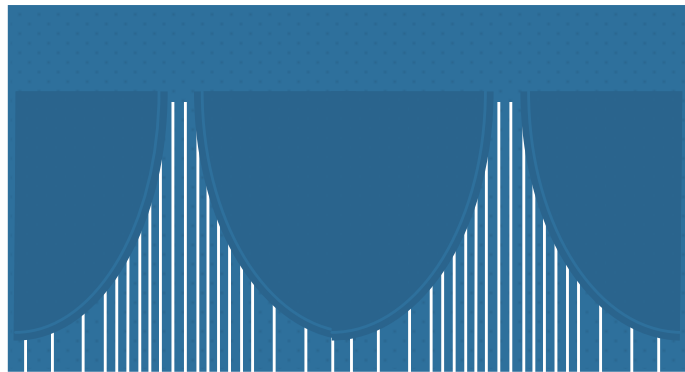
Detailed MAX Competitive Product Review/Analysis

- Cisco AS5200
- US Robotics Total Control Hub

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Detailed MAX Competitive Product Review/Analysis



C I S C O S Y S T E M S

Cisco AS5200



Cisco AS 5200/5300 Description

- **Modular, 3-slot system for integrating modems, T1/E1 and PRI**
- **The modem technology from Microcom is in question since Compaq's acquisition and Cisco's acquisition of Telebit**
- **LAN-to-LAN routing support for IP, IPX and Appletalk**
- **Support for up to 48 /96 modems(AS 5200/5300) and 2/4 T1/E1s or PRIs per box**
- **12/24 ports per modem card (AS 5200/AS 5300)**
- **Support for integrated analog/ISDN (48/96 concurrent sessions)**
- **List Prices:**
 - AS 5200: \$ 461 per port
 - AS 5300 : \$ 468 per port



Key Cisco Attack Points

- **The Cisco AS5200 was never ready for ISP/Carrier-class Solutions; AS5300 is late and has just caught up with MAX 40XX**
- **Loosely integrated solution**
- **“Buggy” and problematic product -**
 - ◆ Price cuts and attempted giveaways within months of the AS5200 release
 - ◆ Field record is awful
 - ◆ Packet load tests have shown severe packet loss; more severe for larger packet sizes
 - ◆ Internal evaluations demonstrated difficult configuration, authentication problems, instability after manual reset/loss of carrier



Key Cisco Attack Points

- **Have already introduced the “AccessPath”; expected to abandon the 5200 and move to AS5300 when it is available**
 - ◆ Purchase protection? Cisco’s direction with this product is not clear
- **Single product solution - No scalable product offerings - no other products to complement full scale deployment**
- **No Carrier-class Solution**
- **Limited security - No dynamic firewall, limited RADIUS**



Ascend's Response to Cisco Marketing Claims

Cisco's Claims:

Superior performance (citing Data Communications article)

Strong CiscoIOS software capabilities

Comprehensive Security Management

Ascend Response:

- Based on tests using 64 byte size packets - this is not representative of real world traffic! Real world traffic has packet sizes typically between 738 and 1400 bytes
- Tolly Group tests recreating Data Communications test bed and simulating real world traffic show MAX's performance approaches the theoretical throughput limit
- Proprietary software - industry is moving toward standards-based approach
- Software comes at premium price, and requires additional DRAM purchases
- No dynamic firewall
- Limited RADIUS extensions

“Ascend has the Features and Scalability that Customer's Demand, with a 3 Year Track Record as Market Leader”



Detailed MAX Competitive Product Review/Analysis



Total Control Hub

US Robotics Description



- **The USR Total Control is #2 in market share, predominantly in analog modem ports**
- **Modular 16-slot system that integrates T1/E1 and ISDN PRI**
- **Currently supports up to 48 modems, 2T1/E1s or 10 PRIs**
 - ◆ Maximum port density: 576/Telco rack
 - ◆ Maximum concurrent sessions/box: 230
- **Announced higher density product in late summer 1997**
 - ◆ 336 analog or ISDN ports/box
 - ◆ 2016 concurrent sessions/Telco rack
 - ◆ Multimodem ports support two DSPs/port - 24 ports/card
- **Ethernet and Token Ring support**
- **Protocol support : IP and IPX**
- **List Price, fully configured system: \$44,126 for 48-port bundle**

Base chassis:	\$5,490
Dual port PRI/T1 card:	\$4,738
12-port digital modem card:	\$2,435
Price/modem:	\$920

[Price per high-density port): \$525]



Key US Robotics Attack Points

- Uncertain software and management platforms, low ISDN PRI market share; developing own code after licensing agreement with Livingston is terminated (released for NetServer/Total Control lines)
- Current product has low modem density, and fewer integrated sessions (48/box vs 72 for the MAX)
- Limited security - no dynamic firewall, limited RADIUS
- Inadequate bandwidth management and control compared to the MAX
- No support for AppleTalk, OSPF, RIP2
- Unclear VPN strategy
- Proprietary x2 56K implementation is not interoperable with over 70% of the modem installed base

Ascend's Response to USR Marketing Claims



USR's Claims:

Ascend Response:

Market leader in analog modems

→ Ascend has maintained its early position as the market leader in ISDN dial-up with over two-thirds market share. The MAX has steadily gained analog port share at USR's expense

Superior, reliable performance

→ Recent Tolly Group test demonstrated the Total Control's performance peaked at 16 sessions

Low cost upgrades to x2 56K technology

→ Doesn't have the density or field track record to compete as a Carrier-class product

→ x2 is a proprietary technology that requires the client and ISP to have a USR modem

→ At this time x2's line speeds are approaching less than a 30% improvement over 28.8 modems; USR has not released performance data/claims

Comprehensive Security Management

→ No dynamic firewall

→ Limited RADIUS extensions

“The Total Control is Not a True Multiservice, Multiprotocol, Carrier-class Concentrator”



Detailed MAX TNT Competitive Product Review/Analysis

- US Robotics HiPerTotal Control Hub
- Bay MSX 5399

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US Robotics HiPer Description



- **Same chassis as current TCH; modular 16-slot system that integrates T1/E1 and ISDN PRI**
 - ◆ 336 analog or ISDN ports/box
 - ◆ 2016 concurrent sessions per Telco rack
 - ◆ Multimodem ports support two DSPs per port/24 ports/card
- **10/100 Ethernet support**
- **Need Access Router card**
- **Protocol Support : IP only**
- **List Price per port: \$525**



Key US Robotics HiPer Attack Points

- **Uncertainty associated with code: Developing own code after licensing agreement with Livingston is terminated (released for NetServer/Total Control lines)**
- **Need access router - not available atleast until year-end 1997**
- **Limited security - no dynamic firewall, limited RADIUS**
- **No track record with high-end access switches**
- **Limited Carrier-class functionality**
- **No support for AppleTalk, IPX, OSPF, RIP2**
- **No T3 support**
- **Unclear about VPN strategy - MAX has VPN support for over one year**
- **Proprietary x2 56K implementation is not interoperable with over 70% of the modem installed base**

Bay MSX 5399 Description



- ◆ Uses System 5000 chassis
 - 14-slot modular chassis
 - A slot each for supervisory module and LAN module
- ◆ 48-port Penril DSP modems with T1(MSX 5399 module)
 - 576 ports per chassis
- ◆ T1/PRI support
- ◆ IP/IPX support
- ◆ K56 and X2 support
- ◆ List Price: \$433 per port



Key Bay MSX 5399 Attack Points

- No track record with access concentrators
- Not truly Carrier-class
- No T3 support
- Limited security - no dynamic firewall, limited RADIUS
- No xDSL support
- No bonding of B-channels between modules
- Limited protocol support
- Performance degradation around 200 sessions (Tolly Group test)



Recent Competitive Developments

■ Cisco Systems

- ◆ AS 5300 will not be available until January 1998
- ◆ “Nitro” high-density, T3 class product in development; based on 72XX engine and MICA technology

■ 3Com/USR

- ◆ HiPer cards delayed until year-end

■ Livingston

- ◆ Acquired by Lucent

■ Shiva

- ◆ Introduced high-density VantagePath access concentrator