Networking Market Trends and Forecasts

May, 1997

Summary

- Telco strength and growing deployment favor xDSL modems over cable modems
- The market for ISDN TAs is fueled by growth in ISDN BRI services, especially in Asia
- The 56K market will grow at approximately 91% CAGR, representing the majority of the low-speed analog modem installed base by 2001
- Growth in Corporate intranets, telecommuting and small businesses will drive the ISDN Router market at a 34% annual growth rate, to become a $4.9 billion market worldwide by 2000
- Access Servers (devices that provide 3-16 dial-up connections via analog/ ISDN BRI ports) will be traded out for Access Concentrators (devices that provide over 17 dial-up ports via high capacity digital access trunks such as ISDN PRIs or T1s)
- ISPs and Telcos are investing in high density, scalable, migratable access concentrators, driving the market to $5.2 billion worldwide by 2000
- Reliability and performance issues drive the demand to replace the installed base of conventional routers with Backbone routers and IP switches
- ISPs are expected to invest heavily in the WAN backbone in the next two years
- As the ISP industry consolidates, future network expenditures will come from Telcos

Cable and xDSL Market Forecast

Relevant Ascend Product:: DSLPipe

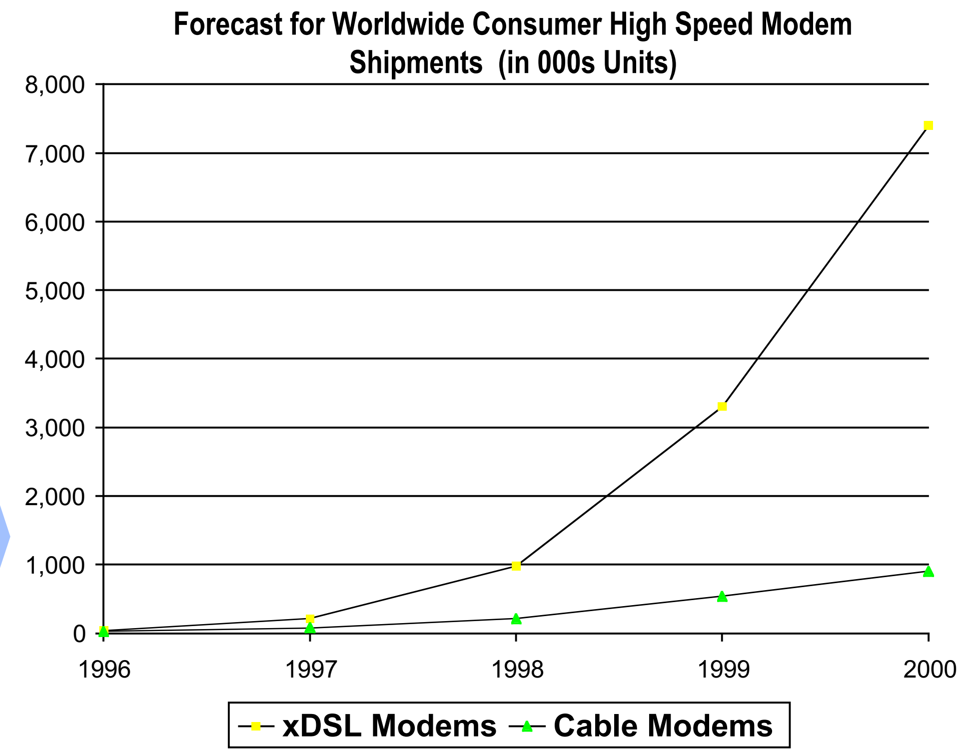
Trends that Influence Market Forecast

Drivers of xDSL growth:

- xDSL answers the Telcos' traffic/cost problem at the CO, and provides the means to comply with local loop access requirements
- Telcos are in a better capital position than cable providers to finance infrastructure
    - In 2000, cable is forecasted to achieve only a 16% market share

Drivers of demand for high-speed dial-up access:

- Transaction-based usage
    - telecommuting
    - integrated call centers
    - home banking
    - electronic benefit transfer
    - purchase of goods and services
- Data streaming for real-time services- voice, audio, video and "server-push" multicasting
- Telco and ISP OEMs
    - Purchase CPE from vendors in order to sell packaged solutions to consumers



Note: This forecast is in unit shipments, revenue forecasts have not been estimated

Forecast in thousands of units-worldwide

	1996	1997	1998	1999	2000
Cable Modems	25	80	210	540	900
xDSL Modems	36	210	980	3300	7400

Source: Dataquest, December 1996

ISDN TA Market Forecast

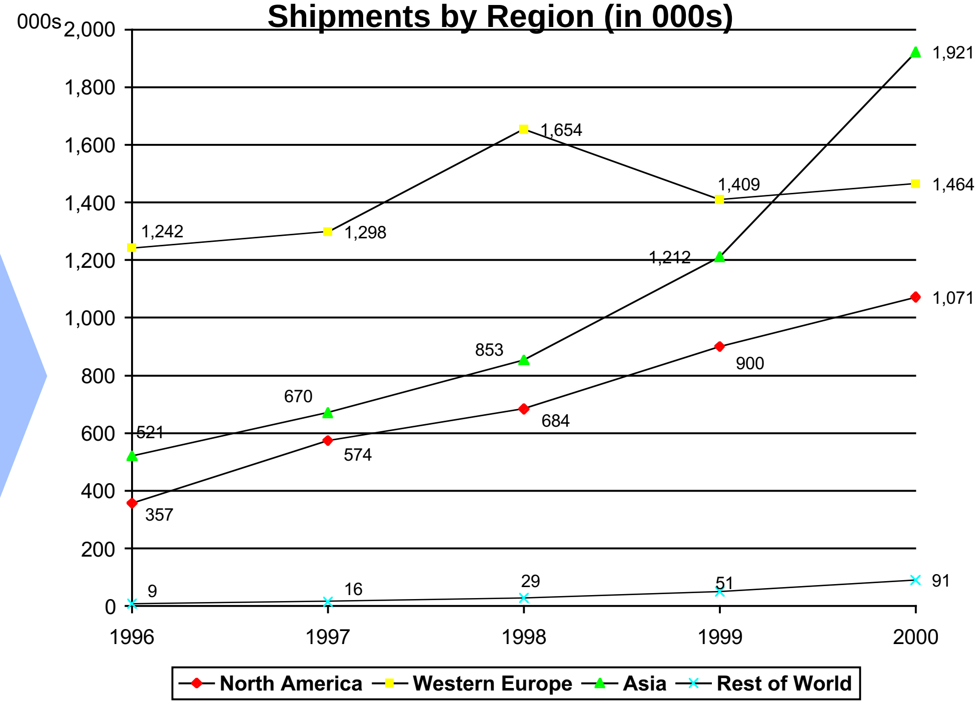
Relevant Ascend Product: Pipeline 15

Trends that Influence Market Forecast

Drivers of ISDN TA growth:

- Continued deployment of ISDN BRI lines by Telcos
  - Germany currently accounts for over 60% of Europe's ISDN lines due to an aggressive policy to upgrade POTS to ISDN at Deutsche Telecom
  - Japan's NTT is also determined to convert its analog network to ISDN; in 1996, Japan accounted for over 95% of Asia's ISDN BRI lines
- Lower equipment prices worldwide
  - ISDN TAs are becoming "mass market" products
  - Continued entry of global players in regional markets
- Better service provisioning and interoperability
- Increasing Internet usage, and demand for future connectivity in Asia

Forecasted Worldwide ISDN Terminal Adapter Shipments by Region (in 000s)



Source: IDC, March 1997

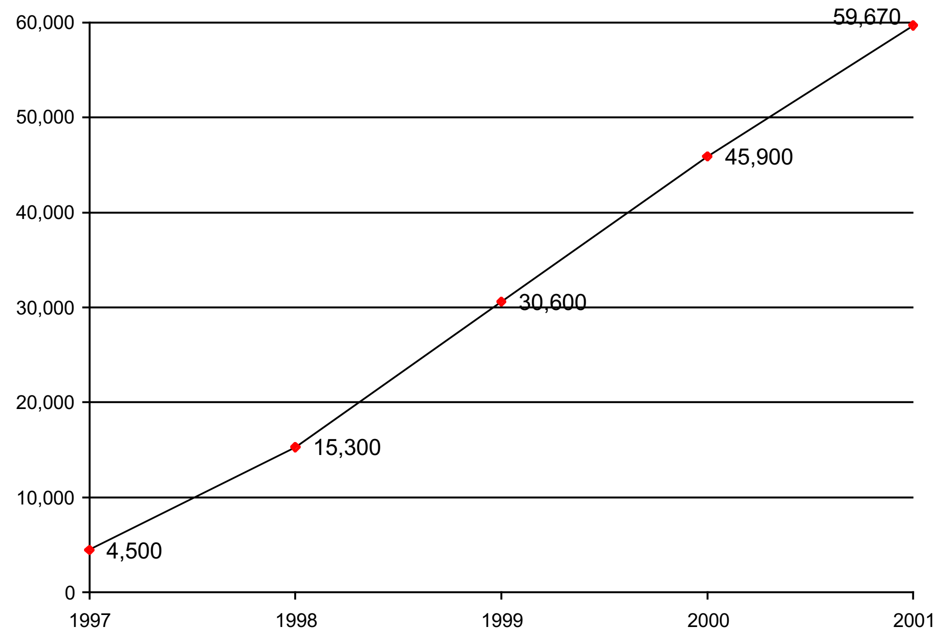
56K Modem Market Forecast

Trends that Influence Market Forecast

56K modem market drivers:

- Consumer/household Internet access
  - Demand for higher speed access by a portion of the approximately 31 million households connected to the Internet using 14.4 and 28.8 modems
  - Migration from V.32bis and early V.34 adapters
- Strong competitive marketing push by USR/TI vs Rockwell/Lucent with their modem and remote access partners
  - 70% of USR's revenues are tied to modems, therefore strategic imperative to create upgrade/ migration cycles
- ISPs will follow customer demand
  - Many will deploy x2 and k56Flex until a standard is adopted
- Corporate enterprises will not adopt 56K for remote LAN access
  - Not standardized
  - Not sufficient bandwidth

Forecasted Worldwide 56K Modem Shipments (in 000s)



Source: IDC, March 1997

- Downward price pressure is expected over the forecast period
  - Introductory pricing from $170 to $300
  - Introductory rebates, trade-ins and software upgrades
  - Expected pricing in 2001: $100/modem or less

ISDN Router Market Forecast

Relevant Ascend Products: Pipeline 25/50/75/130

Trends that Influence Market Forecast

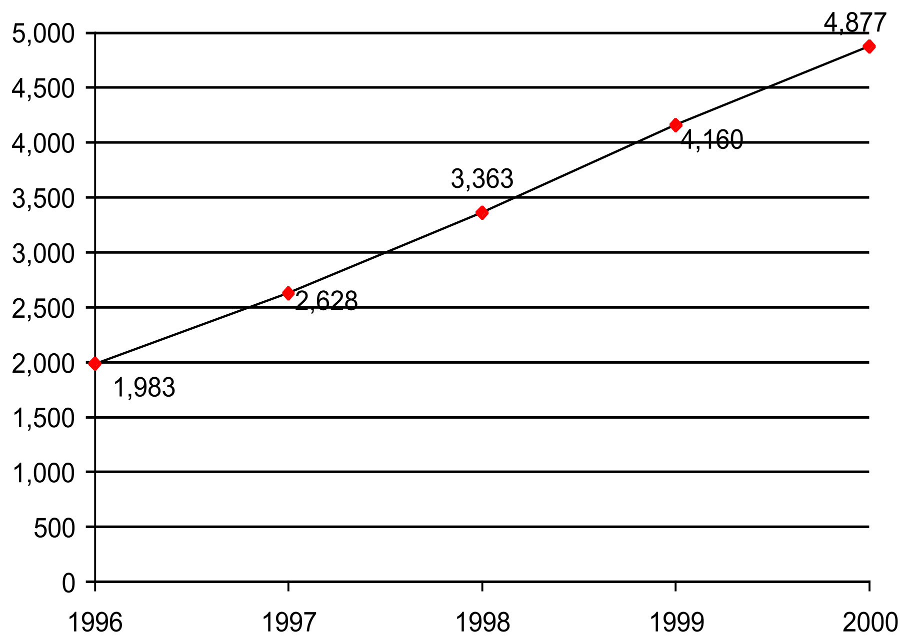
Drivers of demand for low-end routers:

- Telecommuting
  - projected at 28 million workers in 2000 - 50% full-time
- Home office
  - growth projected at anywhere from 15% to 125%
- Small Office
  - growth is projected at 11%
  - secure electronic commerce should accelerate this growth projection
  - 30% of small office's are expected to have LANs in 2000
- Remote/Branch Office
  - growth is projected to continie at a 20% rate as corporations continue to connect remote LANs to the Intranet

Additional influence on revenue projections:

- Downward pressure on price due to increasing competition and the creation of bundled products

Worldwide Revenue Forecast for Branch, SOHO, and Personal Routers (in $M)



Source: Dataquest, December 1996

1996	1997	1998	1999	2000
1,983	2,628	3,363	4,160	4,877

Source: Dell'Oro Group (Oct 96),IDC, Infonetics, Gartner Group

Remote Access Server* Market Forecast

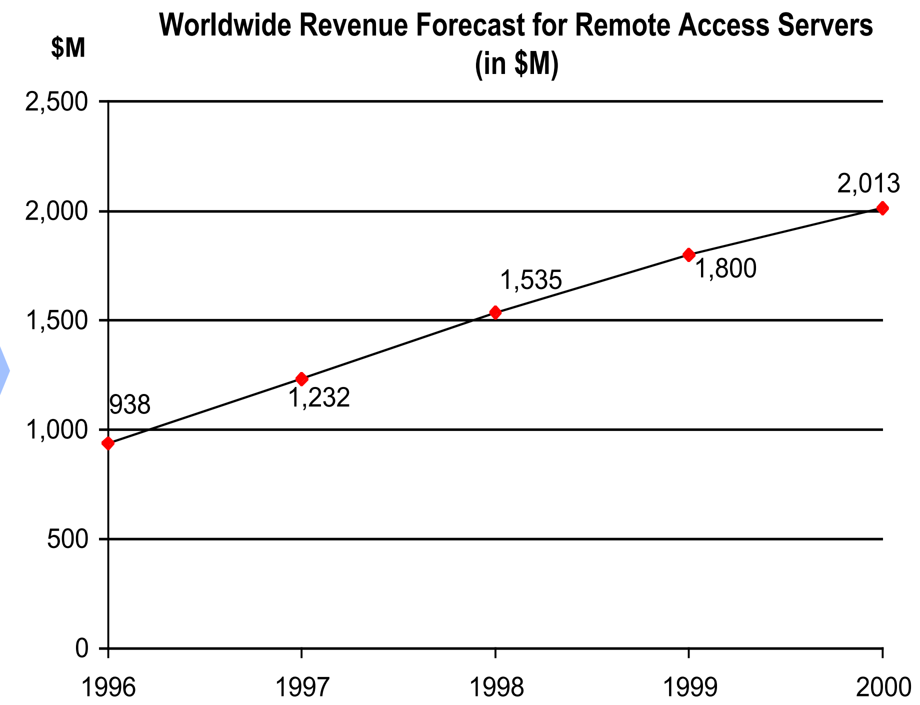
Relevant Ascend Products: MAX 200Plus/1800

Trends that Influence Market Forecast

Drivers of demand for remote access servers at the corporate enterprise and its branch offices:

- Focus on lowering network costs
- Global presence requires ubiquitous global network remote access
- Increasing worker mobility
- Need to enable collaborative multi-location workgroups
- Need to lower real-estate costs and address Clean Air Act requirements by moving workers off site
- Integrated electronic access / voice access call centers
- Need for increased bandwidth to desktops to utilize data warehousing /data mining and to integrate voice/data/video
- Need to leverage electronic commerce for A/R and A/P systems, on-line sales, micromarketing/cross selling

Negative driver: trend toward outsourcing remote access services



Source: Dataquest, December 1996

1996	1997	1998	1999	2000
938	1,232	1,535	1,800	2,013

* Access Servers are defined as devices that provide 3-16 dial-up connections via fixed analog/ ISDN BRI ports

Remote Access Concentrator* Market Forecast

Relevant Ascend Products: MAX 400X/TNT

Trends that Influence Market Forecast

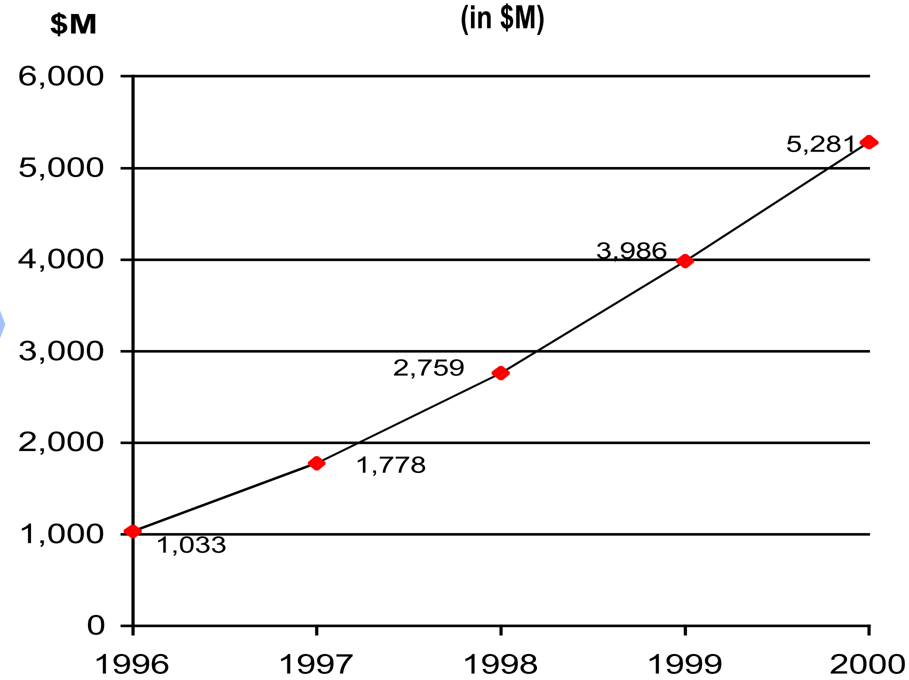
Drivers of demand for remote access concentrators at the ISP:

- Aggressive investment in high density/low cost/per port systems
  - competitive pressures lead to commodity pricing on services
  - market consolidation- # of ISPs to shrink from 4000 to 100 by 2002
- New outsourcing services for remote access and extranets (secure access) to large corporate, and small to medium sized customers
- Need for scalability as consumer access increases at over 175%/year

Drivers of demand for remote access concentrators at the Telcos

- Protect consumer and business franchise from competitive threats from other Telcos, ISPs, and Cable providers by
  - providing low cost Internet services as part of a bundled, branded product offering
  - delivering other business and entertainment services

Worldwide Revenue Forecast for Remote Access Concentrators (in $M)



Source: Dataquest, December 1996

1996	1997	1998	1999	2000
1,033	1,778	2,759	3,986	5,281

* Access Concentrators are defined as devices that provide over 17 dial-up ports via high capacity digital access trunks such as ISDN PRIs or T1s

Backbone Router/IP Switch Market Forecast

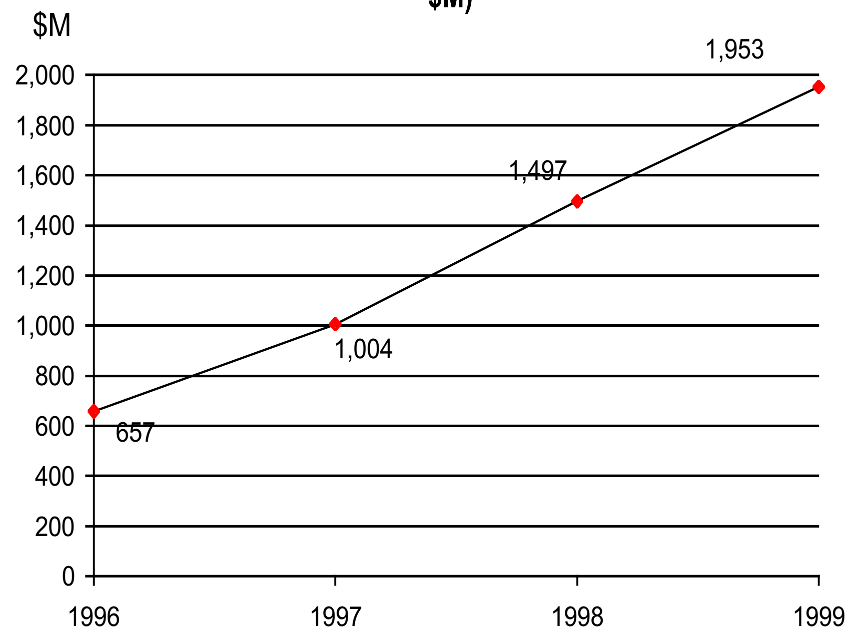
Relevant Ascend Products: GRF 400/1600

Trends that Influence Market Forecast

Drivers of demand for Backbone Routers and IP Switches

- Internet traffic/congestion problems
  - current routers have reached their architectural capacity
  - accelerated growth in usage and need for reliability as mission critical operations, transactions, and commerce are put on-line

Worldwide Revenue Forecast for Backbone Routers and IP Switches (in $M)

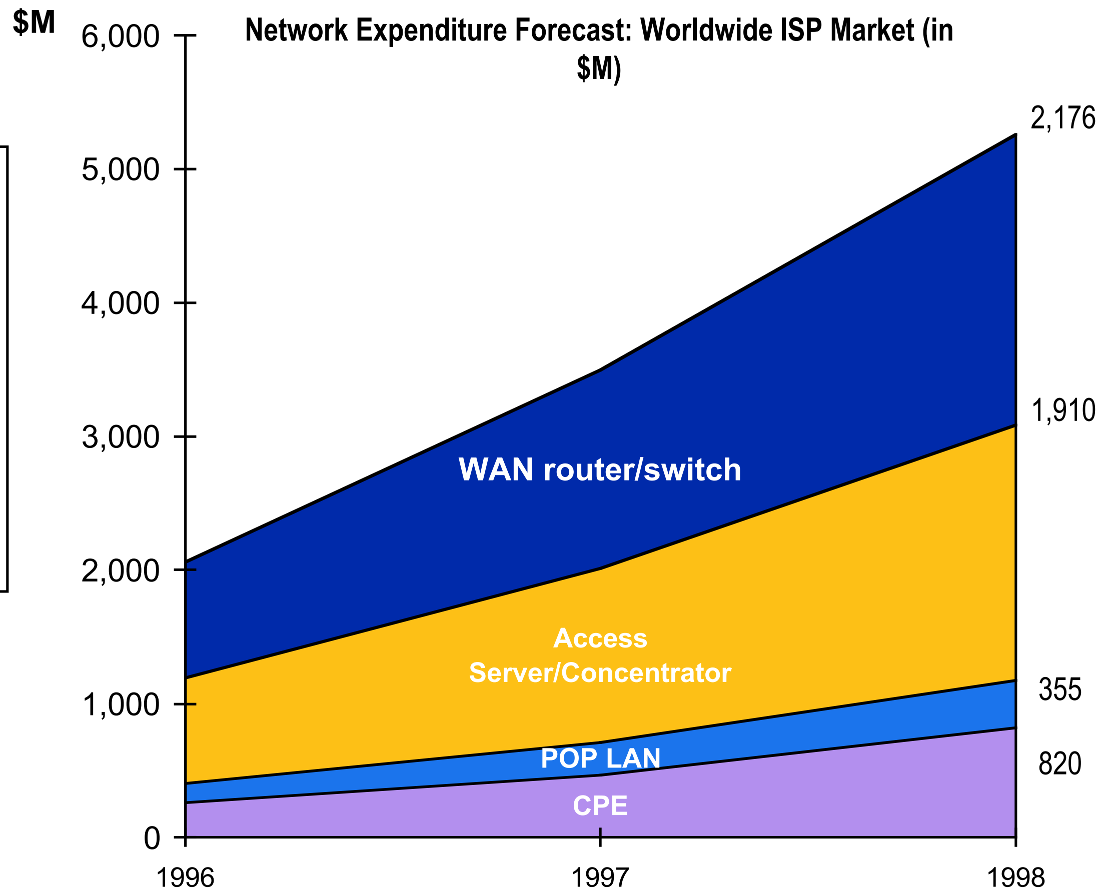


Source:Dell'Oro Group, 10/96; Ascend Analysis

1996	1997	1998	1999
657	1,004	1,4971	,953

While the Majority of ISP Network Expenditures are Expected in the WAN Backbone. . .

- Total Forecasted ISP Network Expenditures 1998: $5.23 Billion
- ISPs will increase their purchases of CPE Equipment by over 200% in two years
- The majority of Network Spending dollars (43%) will be in the WAN backbone



Source: Infonetics

. . . ISPs will Represent a Shrinking Share of Network Expenditures

ISP spending will represent a declining share of network dollars as the industry consolidates, Telcos acquire ISPs, and Telcos build up their own networks:

ISP share of total network expenditures	
1996	43%
1997	40%
1998	40%
1999	34%
2000	30%

Source: Infonetics, Dell'Oro Group, IDC, Ascend Analysis