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Ascend
Competitive Product Guide

Looking at the competition

Larribeau Associates
(415) 241-9920
bob@larribeau.com

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Chapter 1

Introduction and Overview

There are a large number of ISDN routers available on the market today. They all have both Ethernet and ISDN connections. Does this mean that they are all the same? Does it mean that users can pick any of them and with the same result?

The answer is definitely “no”.

These products vary widely in application, performance, ease of use, and manageability. This Guide provides the results of head-to-head, hands-on testing to show you how Ascend’s Pipeline® series products stack up to the competition.

We evaluated more than 20 ISDN routers connecting to an Ascend MAX™ 1800 WAN access switch. We tested interoperation, performance, and usability.

Key Evaluation Criteria

Performance is a key criteria in selecting a client router. After all, the primary reason for buying ISDN is increased **speed**. There are two factors that have a significant effect on throughput. The first is support for the Multilink PPP (MP). MP doubles the wire speed of a connection by combining the two 64 Kbps B-channels of an ISDN BRI line into a single 128 Kbps logical channel.

The second factor that affects speed is **compression**. Compression can increase the effective throughput of an ISDN connection by as much as a factor of four. One of our test files showed an improvement of 250% using compression with the best products. The combined effect of MP and compression is to increase throughput of an ISDN connection from 60 Kbps to over 300 Kbps with this compressible test file.

Beyond speed, a third key criteria for comparing ISDN routers is their **user interface**. These products are often used by end users, not network administrators. It has to be as simple as possible to set them up and use them for these end users to be successful.

There are three kinds of user interface that have been implemented. The most basic interface is a *command line interface*. This style of interface is difficult to use and to learn. A command line interface is not acceptable for an end-user and many companies have implemented PC-based graphics user interface utilities in order to eliminate the need to use the command line interface directly.

A number of companies have improved on the command line interface by implementing a character-*based menu interface* that runs directly on the router. In most cases this type of interface makes it much easier to set up the configuration because all of the parameters are shown in the menus and it is easy to step through the applicable values. Most of these user interfaces are easy for an end-user to learn.

The best interfaces are provided by *graphics user interface* utilities that run on PCs. The best of these graphics utilities automatically discover the router on the Ethernet and use the Ethernet for all communication with the router and are able to fully configure the unit.

Some products include graphics utilities that can be used only for the initial set up and do not provide the ability to modify all of the parameters of the device. These utilities are more useful for giving demonstrations than for managing an ISDN client router and are not very useful in real applications.

Voice support is important in applications like telecommuting. In addition to accessing the corporate networks, telecommuters need to talk on the phone or send and receive faxes. A single ISDN line with the appropriate equipment will support all of these applications.

Table 1.0 shows how the products that we tested stack up against these criteria. Our test bed included an Ascend MAX 1800. A "Yes" in the "MP" or "Compression" column means that the ISDN client router tested were able to interoperate with the MAX 1800 using MP or compression respectively.

Table 1.0 Feature Comparison

	MP	Compression	GUI	Voice
Ascend Pipeline 25-*Fx*	Yes	–	Yes	Yes
Ascend Pipeline 25-*Px*	Yes	–	Yes	Yes
Ascend Pipeline 50	Yes	Yes	Yes	–
Ascend Pipeline 75	Yes	Yes	Yes	Yes
Ascend Pipeline 130	Yes	Yes	–	–
3Com Office Remote 530	Yes[1]	–	–	Yes
ACC Congo Voice Router	Yes	–	–	Yes
ADC Kentrox Pacesetter Pro	Yes	Yes	–	–
ADC Kentrox Pacesetter SOHO	Yes	Yes	–	Yes
Adtran Express XL	Yes	Yes	–	Yes
Bay Networks CLAM	Yes	–	–	Yes
Cisco 1004	Yes[2]	–	–	–
Cisco 2503	Yes[2]	–	–	–
Cisco 766	Yes	–	–	Yes
Farallon Netopia 440	Yes	–	Yes	–
Farallon Netopia 635	Yes	Yes	–	Yes
Flowpoint 122	Yes	Yes	Yes	Yes
Gandalf XpressConnect 5242i	Yes	Yes	Yes	Yes
Motorola Vanguard 312 Plus	Yes	–	–	Yes
Proteon Globetrotter 72	Yes	–	–	Yes
Ramp Networks Webramp	Yes[3]	–	Yes	Yes
Shiva AccessPort	Yes	–	Yes	–
ZyXEL 2864i	Yes	Yes[4]	–	Yes

[1] Required upgrade to beta level software
[2] Required upgrade to later software release
[3] Brings up 2nd channel based on only load from router
[4] Supports only Microsoft compression negotiation

A "Yes" in the GUI column means that the client router has a Graphics User Interface (GUI) utility that is capable of fully configuring the device. GUI utilities that can configure only a subset of the ISDN client router's parameters did not receive a "Yes" in this column.

Only the Ascend Pipeline 50 and 75, the Flowpoint 122 and the Gandalf 5242i met all these criteria. They all support MP Protocol and compression, and have a GUI configuration utility. The Ascend Pipeline 50 supports only data; the others support data and voice. The Flowpoint and the Gandalf had shortcomings that are described in Chapter 3. We found no issues with the Ascend products that gave us any reservations.

Other Selection Criteria

Other criteria are important in deciding which router best fits the needs of a specific application. These features are described in detail in the sections that cover each product. These criteria include:

- Price
- Limitations the number of network devices supported
- Routing Support
  - IP Routing
  - IPX Routing
  - Bridging
- Security
  - PAP/CHAP
  - Callback security
  - Calling Line ID screening
  - SecureID token card support
- Voice
  - Number of POTS ports
  - Ability to preempt a data call to make an outgoing POTS call
  - Ability to preempt a data call to receive an incoming POTS call

You should review the detailed descriptions of each product contained in this document to understand how each product supports these and other important features.

Performance

We ran a set of throughput tests to determine the performance of each of these products. Two files were used:

- **.xls** – a 289,000 byte Excel file
- **.zip** – a 75,000 byte file that is the **.xls** file that has been put through PKZIP.

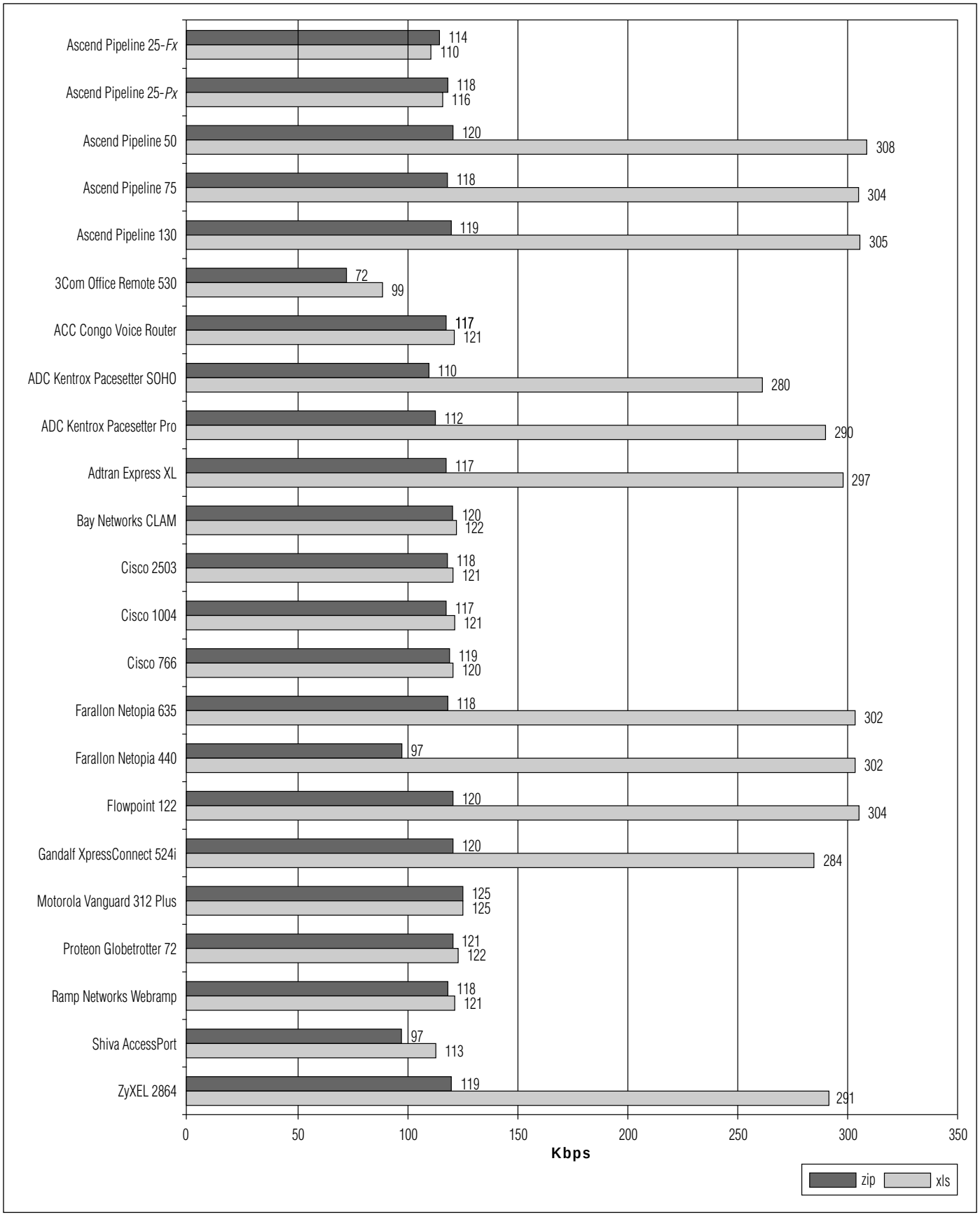
The **.xls** file shows the effect of compression. The size of the **.zip** shows that a compression factor of nearly 4:1 is possible. The best product, like the Ascend Pipeline series, was able to achieve about 2.7:1 compression.

The **.zip** file shows the performance with an incompressible file. The best products showed performance of 120 to 125 Kbps out of a possible 128 Kbps possible.

The chart on the next page shows the results. All of the products were able to operate with MP with the MAX 1800. It is easy to see the effect of compression.

Note how the throughput on the **.xls** file shows the effect of compression.

Also note the excellent times of the Ascend Pipeline 50, 75, and 130 products.


Ascend Pipeline 25-Fx
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Chapter 2

Ascend Pipeline Products

The Ascend Pipeline products are the clear leaders in this group of ISDN client routers. They have the best performance, competitive prices, and are fully featured. They are fully interoperable with the Ascend MAX series of WAN access switches, including support for Multilink Protocol Plus™ (MP+) (RFC 1934) that simplifies the setup and optimizes the performance of remote access applications.

The Ascend Pipeline product line consists of five products. Each of them is targeted to specific application. The table below gives an overview of each of their capabilities:

Model	Pipeline 25-*Fx*	Pipeline 25-*Px*	Pipeline 50	Pipeline 75	Pipeline 130
Price	$595	$695	$895	$995	$1,895-$1,995
Local Users	4	1	Unlimited	Unlimited	Unlimited
Bridging	Yes	No	Yes	Yes	Yes
IP Routing	No	Yes	Yes	Yes	Yes
IPX Routing	No	No	Yes	Yes	Yes
Private Line/ Frame Relay	No	No	No	No	Yes
POTS Ports	2	2	None	2	None
Application	Connect a home network to the headquarters LAN	Connect a single computer to the Internet	Dial-up connections from remote offices	Telecommuter	Overflow or backup with dedicated access

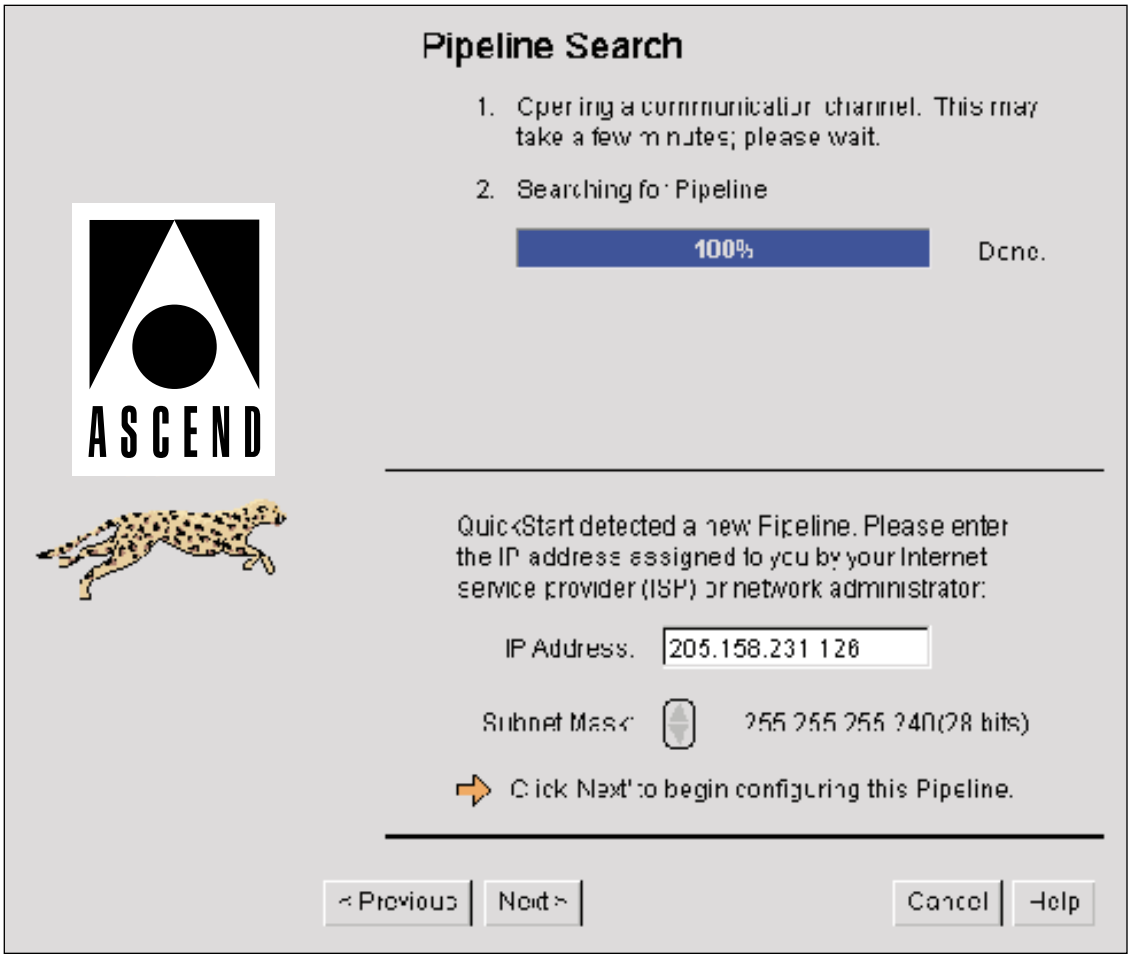
The Pipeline series share two hardware platforms. The two Pipeline 25 products use a Motorola 68302 processor and the Pipeline 50, 75 and 130 use the Motorola 68360. All Pipeline models are available with either the U-interface or the S/T-interface. Except for the Pipeline 130, they all have FCC Class B certification which makes them suitable for home use. With its dedicated facility support, the Pipeline 130 is targeted toward business applications and has FCC Class A certification.

Ascend has recently introduced a Java based graphic user interface that support all of the Pipeline series products with the exception of the Pipeline 130. This user interface has three components:

- A utility to set up a brand-new Pipeline router
- A utility to configure all of the features of the Pipeline products
- A run-time monitor of a Pipeline unit's call activity

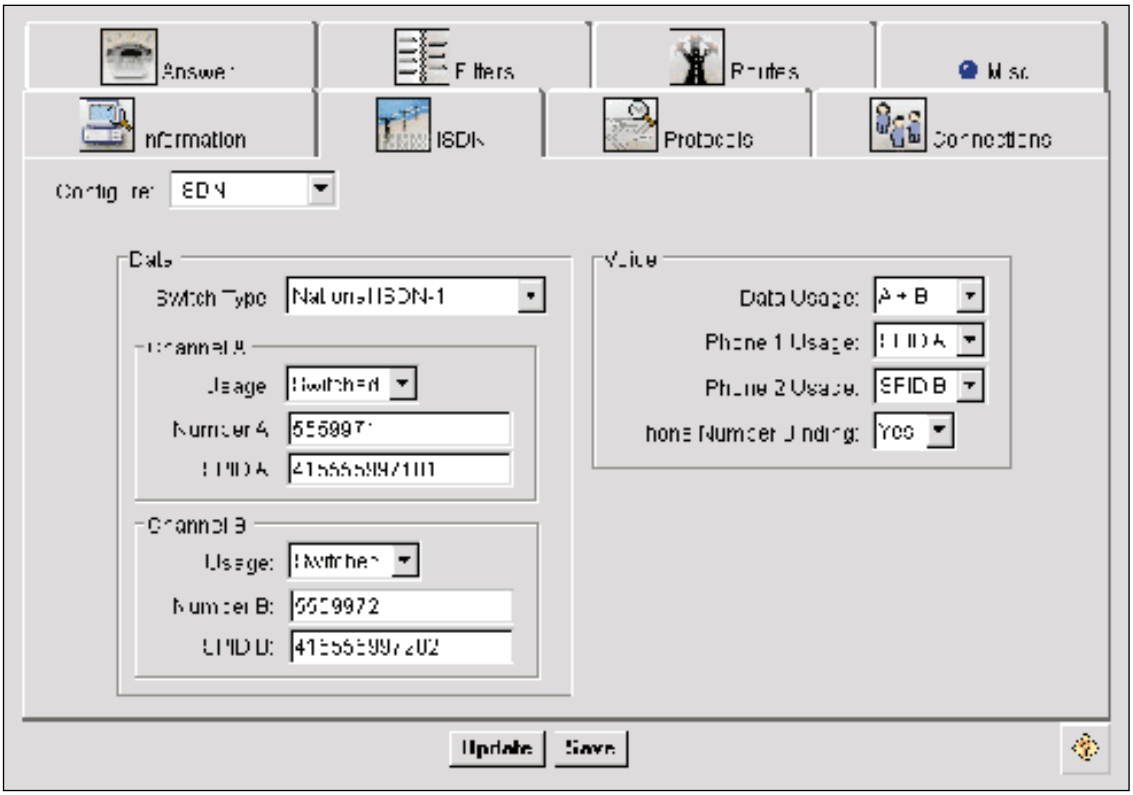
All three of these utilities automatically discover the Pipeline products on the LAN. Using the LAN for communication between the utility and the Pipeline router gives excellent performance.

The screen below shows a screen from the start-up utility. It shows the results of the search for a brand-new Pipeline. It also shows how the IP address of the Pipeline router is set up. The Pipeline utility then leads you through the rest of the set up. The start-up utility does include a test of the ISDN setup to be sure that the phone numbers and SPIDs have been entered correctly.

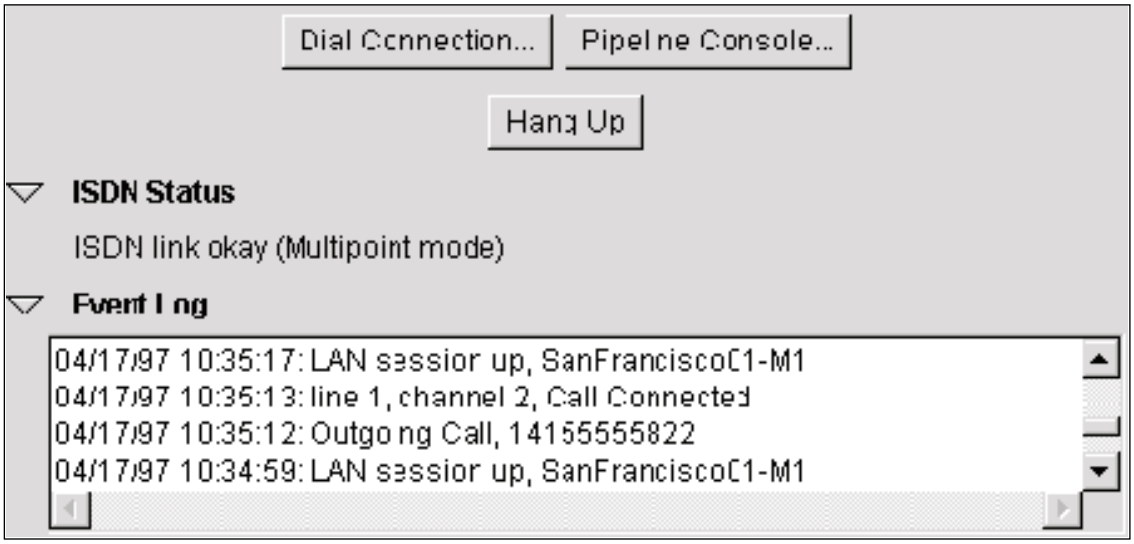


The ISDN screen on the next page shows the configuration utility. It shows how the phone numbers and SPIDs for the ISDN line are entered and how to specify that the two B-channels are used for voice and/or data usage. It also shows the other tabs that are available to specify the other aspects of the router including protocols, connection profiles, filters and routes.

This Java-based utility simplifies the setup considerably. The utility discovers the Pipeline router on the Ethernet automatically, so it is not necessary to use the serial port on the unit to enter an IP address or other start-up information. All information is communicated over the Ethernet so performance is excellent.



The screen below shows the monitor screen. It shows the status of the ISDN line and an event log that shows all outgoing and incoming calls.



The Pipeline series have a native, character based menu system that can be accessed over the serial port or via a Telnet session over the Ethernet. An example of this interface is shown in the Pipeline 130 description later in this chapter. This interface is easy to navigate and shows useful dynamic status information.

The Pipeline 50, 75 and 130 share the same software feature set. All three products provide full support of PPP options, including Data Over Speech Bearer Service (DOSBS) that lets you send data and be charged voice tariffs and the Bandwidth Allocation Control Protocol (BACP), which is an IETF standard for dynamically adding or subtracting B-channels on a MP connection. These three products also support a full set of routing protocols – bridging, IP routing and IPX routing. The only difference is that the Pipeline 130 does not support IP Address Translation that permits the sharing of a single user Internet account on a LAN.

These products also share a full set of management and security features including PAP/CHAP authentication along with callback and Calling Line ID (CLID) authentication. They also support SecureID and other token cards that are used to further enhance access security.

The Pipeline 50, 75 and 130 has two levels of network security. Like many similar products they come standard with packet filtering that can be used to create simple firewalls to protect network resources from intrusion by outside threats. These three Ascend Pipeline products support a unique, add-on Secure Access™ Firewall system that provides much better protection than simple packet filtering.

The Pipeline 25 products are targeted to specific applications and their capabilities are described below.

The two Pipeline 25 products and the Pipeline 75 all have two POTS ports. These ports can be programmed to accept calls from either or both of the phone numbers assigned to the ISDN line. When both B-channels are in use for a data transfer, these products can be programmed to permit the preemption of one or both of the B-channel data calls for either incoming or outgoing voice calls. This means that you don't lose the ability to make or receive calls because you are accessing a remote network. These three products also support voice features including Hold, Conference, Drop, Transfer and Calling Line ID (CLID).

Pipeline 25-*Fx*

The Pipeline 25-*Fx* is a bridge that is capable of supporting networks with up to 4 workstations. It is intended for supporting the telecommuter with a small network in their home. The Pipeline 25-*Fx* is a dial-in device so authentication is limited to PAP/CHAP, Callback and SecureID authentication. Calling Line ID is not required since the Pipeline 25-*Fx* will generally not be used to support incoming calls.

4 user bridge	
Software Version Tested	5.0a
Pluses: + Fully interoperable with Ascend MAX + Supports PPP MP+ + Supports Voice + Cost-effective	
Minuses: – Does not support compression – Bridge only	

Pipeline 25-*Px*

The Pipeline 25-*Px* is intended for high-speed, home Internet access for a single user. It is fully one-third faster than the terminal adapters that are often used for Internet access. The 25-*Fx* uses 10 Mbps Ethernet interface, which is a much better fit to ISDN speeds than the 115 Kbps serial interface found on most PCs.

Single-user bridge	
Software Version Tested	5.0a
Pluses: + Fully interoperable with Ascend MAX + Supports MP+ + Supports Voice + Cost-effective	
Minuses: – Does not support compression – Does not support callback, Calling Line ID, or SecureID access security	

The Pipeline 25-*Fx* supports only IP routing and PAP/CHAP authentication, which is just what you need to access the Internet. The 25-*Fx* can also provide remote access to the corporate IP network. Companies that want a higher level of authentication than PAP/CHAP will prefer other Pipeline products that support callback, CLID and SecureID authentication.

Pipeline 50

The Pipeline 50 is a high-performance router than can connect a full LAN to the corporate network or to the Internet. It supports a full set of ISDN, routing, and security options. It gives the best performance of any of the products tested. A Java-based Configurator along with features such as Network Address Translation and DHCP Spoofing provide an easy and economical way to set up and configure the unit. The Pipeline 50 is well suited for IP, IPX, and other network applications. The security options include PAP/CHAP, callback, CLID and SecureID authentication.

Multi-user bridge	
Software Version Tested	5.0a
Pluses: + Fully interoperable with Ascend MAX + Supports MP+ + Excellent performance + Supports optional Firewall system	
Minuses: – Network Address Translation supports only one connection profile at a time.	

Pipeline 75

The Pipeline 75 is a high-performance router than can connect a full LAN to the corporate network or to the Internet. It supports a full set of ISDN, routing, and security options. It gives the best performance of any of the products tested. A Java-based Configurator along with features such as Network Address Translation and DHCP Spoofing provide an easy and economical way to set up and configure the unit. The Pipeline 75 is well suited for IP, IPX, and other network applications. The security options include PAP/CHAP, callback, CLID and SecureID authentication.

Multi-user bridge	
Software Version Tested	5.0a
Pluses: + Fully interoperable with Ascend MAX + Supports MP+ + Excellent performance + Supports optional Firewall system + Full voice support	
Minuses: – Network Address Translation supports only one connection profile at a time.	

The Pipeline 75 includes two POTS ports that support voice, fax or modem calling. These POTS ports support both incoming and outgoing call preemption and the Hold, Conference, Drop, Transfer and Calling Line ID features.

Pipeline 130

Multi-user bridge	
Software Version Tested	5.0a
Pluses: + Fully interoperable with Ascend MAX + Supports MP+ + Excellent performance + Supports optional Firewall system + Full voice support	
Minuses: – Network Address Translation supports only one connection profile at a time.	

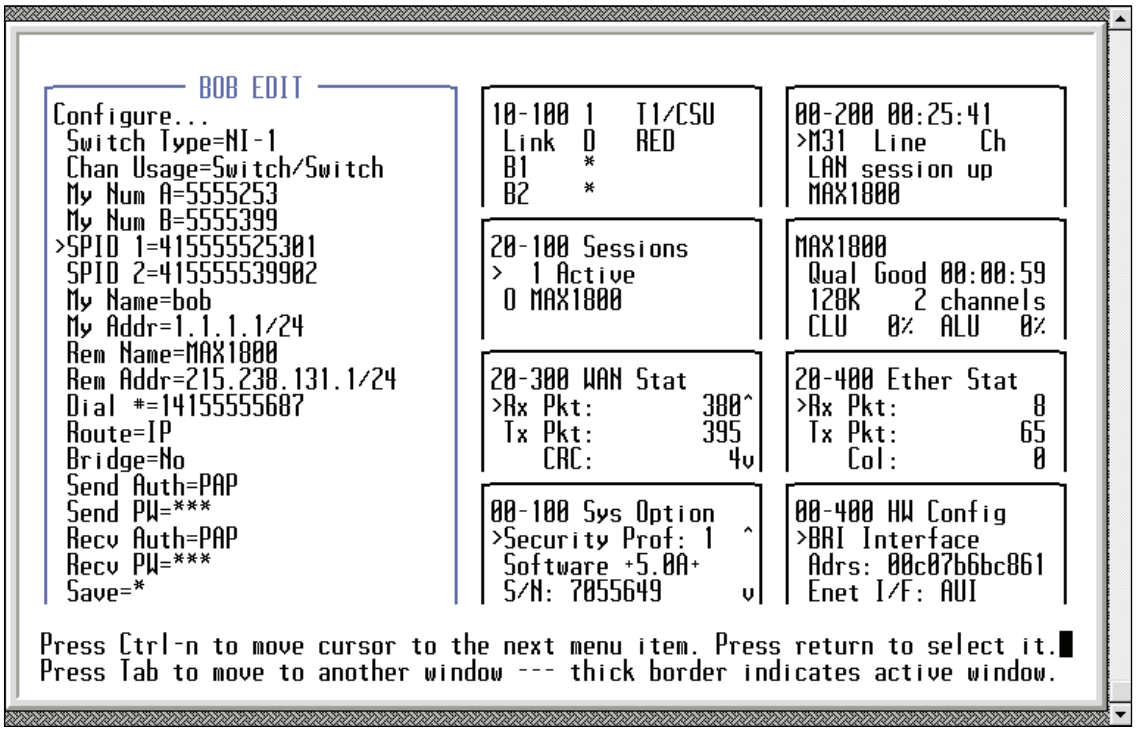
The Pipeline 130 is a high-performance router than can connect a full LAN to the corporate network or to the Internet. It supports a full set of ISDN, routing and security options. It gives the best performance of any of the products tested. The Pipeline 130 is well suited for IP, IPX, and other network applications. The security options include PAP/CHAP, callback, CLID and SecureID authentication.

The Pipeline 130 supports 56 Kbps, T1 and fractional T1 facilities as a dedicated service router. The ISDN connection can then be used as a back-up or overflow facility. As a backup an ISDN connection can be made when the dedicated facility fails. The ISDN connection will come up in only a few seconds and provide 128 Kbps of bandwidth.

The ISDN connection may also be programmed to come up whenever the dedicated facility is satisfied, providing 128 Kbps of additional bandwidth. This can improve the performance as the network becomes overloaded.

The Pipeline 130 is supported by its integrated character menu system. The Java-based user interface utility does not support it. An example of the this user interface is shown below.

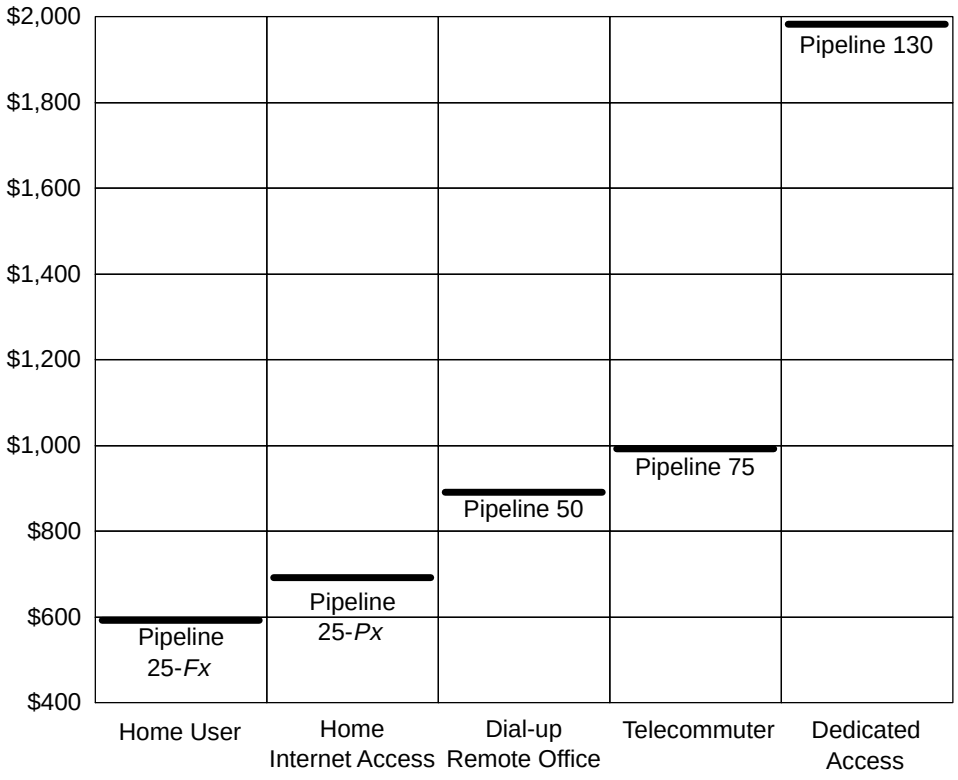
The left most column shows the basic ISDN setup screen with the phone numbers, SPIDS, IP address and so on of this unit. In the small window in the top center of the screen labeled “10-100”, “Link D” shows that the ISDN line is working. The “*” next to “B1” and “B2” show that B1 and B2 data calls are up. Just below in the window labeled “20-100” the “0 MAX1800” shows that IP is working to the remote network through the access router with the name “MAX1800”.



Product Comparison

The table below shows the applications and pricing for each of the Ascend Pipeline products. This table will be repeated to show how each manufacturer's products compare to the Pipeline series. Each column fits the following application:

- **Home User:** for home users looking for cost-effective access to the corporate network
- **Home Internet:** for home users looking for cost-effective, high-performance Internet access
- **Dial-up Remote Access:** for the user who want the best possible performance linking remote office networks to the corporate LAN or to the Internet
- **Telecommuter:** for the telecommuter who wants the best possible performance for voice and data services over a single ISDN line
- **Dedicated Access:** For the remote location with dedicated network access and wants to use ISDN for network backup and overflow



Product Matrix

The matrix below shows a detailed analysis of the price and features of the Ascend Pipeline products that can be used to compare them against the competitive products.

Company	Ascend	Ascend	Ascend	Ascend	Ascend
Product	Pipeline 25-*Fx*	Pipeline 25-*Px*	Pipeline 50	Pipeline 75	Pipeline 130
List Price	$595	$695	$895	$995	$1,895-$1,995
Hardware					
FCC Certification	Class B	Class B	Class B	Class B	Class A
S/T Interface	Yes	Yes	Yes	Yes	Yes
U Interface	Yes	Yes	Yes	Yes	Yes
Other WAN Interfaces	–	–	–	–	Frame Relay T1/DDS56
ISDN/PPP					
Local Users	4	1	unlimited	unlimited	unlimited
DOSBS	Yes	Yes	Yes	Yes	Yes
MP	Yes	Yes	Yes	Yes	Yes
MP+	Yes	Yes	Yes	Yes	Yes
Compression	–	–	STAC	STAC	STAC
BACP	–	–	Yes	Yes	Yes
Routing					
Bridging	Yes	–	Yes	Yes	Yes
IP Routing	–	Yes	Yes	Yes	Yes
IP Address Xlation	–	Yes	Yes	Yes	–
RIP	–	–	Yes	Yes	Yes
IPX Routing	–	–	Yes	Yes	Yes
IPX Spoofing	Yes	–	Yes	Yes	Yes
Dynamic Bandwidth Allocation	Yes	Yes	Yes	Yes	Yes
# Simult. Connections	2	1	2	2	2
# Profiles	4	1	8	8	8
Management & Security					
PAP/CHAP	Yes	Yes	Yes	Yes	Yes
Callback	Yes	–	Yes	Yes	Yes
CLID	–	–	Yes	Yes	Yes
SecureID	Yes	–	Yes	Yes	Yes
Packet filtering	Yes	–	Yes	Yes	Yes
Dynamic Firewall Support	–	–	Yes	Yes	Yes
SNMP Agent	–	–	Yes	Yes	Yes
Telnet Access	–	–	Yes	Yes	Yes
Proprietary Access	Yes	Yes	Yes	Yes	Yes
TFTP Download	Yes	–	Yes	Yes	Yes
GUI Interface	Yes	Yes	Yes	Yes	Yes
Voice					
# POTS Ports	2	2	none	2	none
Incoming call preemption	Yes	Yes	n/a	Yes	n/a
Outgoing call preemption	Yes	Yes	n/a	Yes	n/a
Voice Features	HCDT, CLID	HCDT, CLID	n/a	HCDT, CLID	n/a

Chapter
3

Competitive Products

This section compares the competitive products against the Ascend Pipeline series products. It shows what features these products have that will give you problems selling the Pipeline series against them. It also shows the knock-offs you can use to counteract the competition.

This chapter includes a section for each of the companies included. There is a table that describes that companies ISDN client router products. It discusses their user interface and includes a typical screen. It then includes a discussion of the results of our testing of each of the products that we tested. There is a table that summarizes the strengths and weaknesses of each products compared to the Ascend Pipeline products.

For each company there is a chart that compares their products against the Pipeline products. The company's products are shown with a solid line and the Pipeline products are shown with a dashed line. When the price of one of the company's products is the same or nearly the same as an Ascend product, then both products are shown with a solid line.

Finally there is a product matrix that includes an entry for each of the company's ISDN router products.

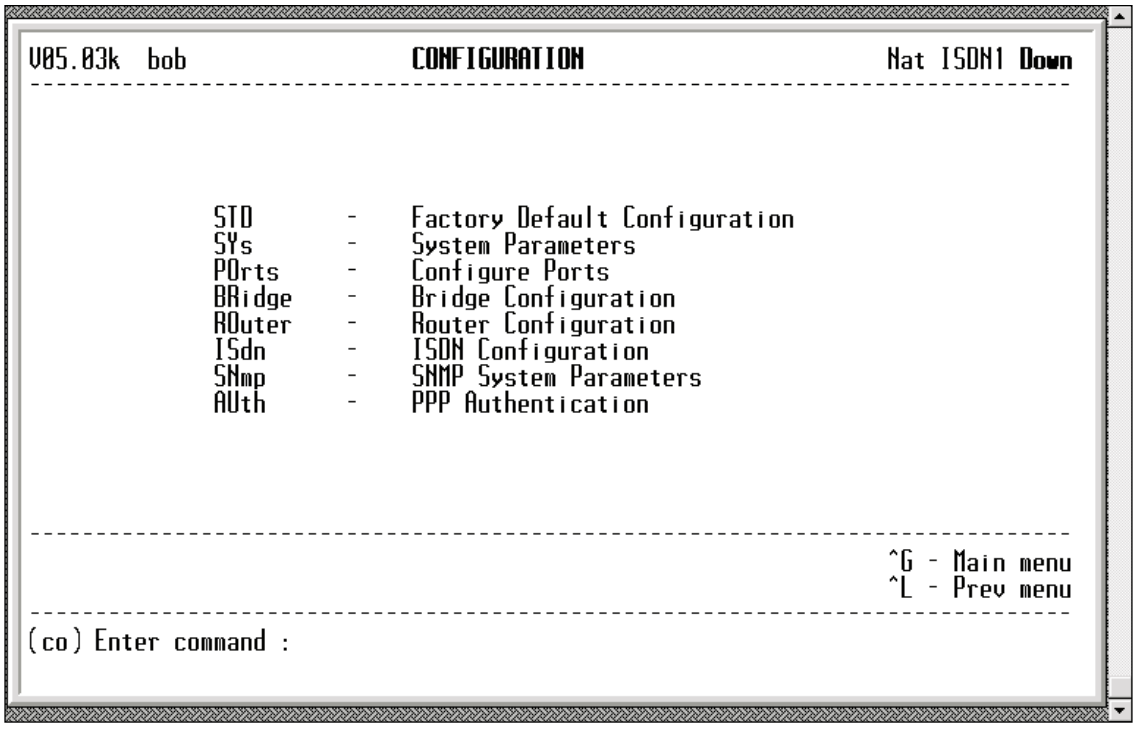
3Com Office Remote

	510	520	530
List Price	$795	$995	$1,495
Routing	Yes	Yes	Yes
Voice	–	–	Yes
Dedicated WAN Facility	–	–	Yes

The 3Com Office Remote ISDN product line includes the three products that are described in the table to the right. These products were developed in Europe for office networking applications. They include strong support for IP and IPX networking including IPX spoofing to minimize ISDN connection time. They also support time-based calling control that limits or prevents calls from being made based on the day of the week or the time of the day. This limits or prevents ISDN calls from being made on nights, weekends, or other times when it is unlikely that a connection is needed to a remote site.

The Ascend Pipeline products also support IP and IPX networking and IPX spoofing but without day and time based call control. The Office Remote products support a proprietary compression protocol that does not interoperate with products from other manufacturers including the Ascend MAX. The Office Remote products also do not support callback or SecureID access security. This gives the Pipeline products a significant advantage where security is an important issue. The Office Remote products do not support MP+ which enhances the ability of the Ascend MAX products to support ISDN remote access using two B-channels.

Software upgrades to the Office Remote products are made through the serial port. They do not support TFTP and cannot use the Ethernet to upgrade software. We found the software upgrade process to be fragile. Our unit failed during an upgrade and had to be returned to the factory for replacement. There was no way to recover from this failure.



The Office Remote products come with the "Transcend" graphics user interface utility. Transcend uses the serial port to communicate with the Office Remote. At 9600 bps it can take a long time to upload or download parameters. The Office Remote also comes with a character-based menu user interface that is easy to use. We found that this internal user interface is easier to use than the Transcend utility and stopped using Transcend.

The screen above shows one of the menu pages from the internal character-based menu system. You enter the first few capitalized letters to select a menu entry. The Office Remote includes a Quick Configuration menu that simplifies the initial setup of the unit.

Product Test: Office Remote 530

We tested the Office Remote 530, which includes an interface for dedicated services up to T1 or E1 speeds. Unlike the Ascend Pipeline 130, it does not support Frame Relay connections. The table to the right shows the significant results of this testing.

Office Remote 530	Multi-user router
Software Version Tested	5.03K

Strengths:

+ Strong IP and IPX networking and IPX spoofing
+ Day and time based call control
+ Supports a large number of remote site profiles
+ Lower price than 530 for dedicated line applications
+ Strong technical support

Weaknesses:

– Proprietary compression significantly reduces throughput connecting to a MAX
– Does not support callback or SecureID access security
– Firewall system not available
– Does not support MP+
– Does not support IP address translation
– Failure loading new software requires returning unit to the factory
– Software bug in 5.03F caused MP to hang with the MAX 1800
– A beta version of 5.03K allowed PPP MP to work with the MAX 1800 but the connection was unstable and throughput was poor
– Does not support incoming or outgoing call preemption
– Does not support Frame Relay on the WAN port

The Office Remote 530 supports strong capabilities for office-to-office networking including IP and IPX networking and IPX spoofing. We found that it will support profiles to at least 20 remote sites compared to 8 remote sites for the Ascend Pipeline products.

The Ascend Pipeline series is stronger for telecommuting and Internet access, especially when used to connect to an Ascend MAX product. The version of MP that we tested had poor performance and was not reliable, even after we upgraded the software.

The lack of compression compatible with the Ascend MAX seriously reduces performance. This is not an issue when the Office Remotes are used to connect with each other in an office-to-office network.

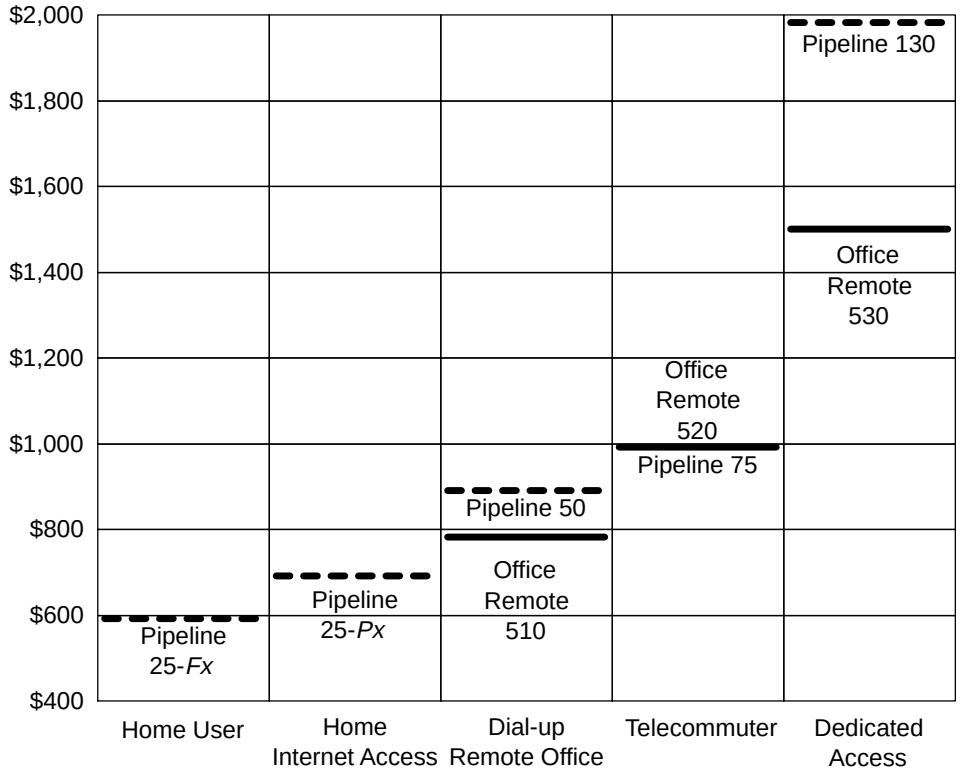
The Office Remote does not have firewall support. It does support packet filtering for the constructing simple firewalls, but it does not support a dynamic firewall package like the Ascend Pipeline products.

The Office Remotes also do not support incoming or outgoing call preemption. This means that voice will be blocked if data calls are up on both B-channels. This makes voice much less useful on these products than on the Pipeline products.

We called 3Com's technical support to get help with the MP problems that we experienced. They were knowledgeable and responsive. They provided us a new version of the software quickly. They also quickly replaced the unit after the software load failed and without a minimum of administrative issues.

Product Comparisons

The chart below compares the Office Remote ISDN products with the Ascend Pipeline series. The Office Remote 510 is about $100 less expensive than the Pipeline 50. The Pipeline 75 and the Office Remote 520 are the same price. The Office remote 530 is about $500 less expensive than the Pipeline 130. There are no Office Remote products that compete directly with the Pipeline 25.



Product Matrix

The matrix below shows a detailed analysis of the 3Com Office Remote ISDN products.

Company	3Com	3Com	3Com
Product	OfficeConnect Remote 510	OfficeConnect Remote 520	OfficeConnect Remote 530
List Price	$795	$995	$1,495
Hardware			
FCC Certification	Class B	Class B	Class B
S/T Interface	Yes	Yes	Yes
U Interface	Yes	Yes	Yes
Other WAN Interfaces	–	–	X.21, V.24, V.35
ISDN/PPP			
Local Users	unlimited	unlimited	unlimited
DOSBS	Yes	Yes	Yes
MP	Yes	Yes	Yes
MP+	–	–	–
Compression	Proprietary	Proprietary	Proprietary
BACP	Yes	Yes	Yes
Routing			
Bridging	Yes	Yes	Yes
IP Routing	Yes	Yes	Yes
IP Address Xlation	–	–	–
RIP	Yes	Yes	Yes
IPX Routing	Yes	Yes	Yes
IPX Spoofing	Yes	Yes	Yes
Dynamic Bandwidth Allocation	Yes	Yes	Yes
# Simult. Connections	2	2	2
# Profiles	20+	20+	20+
Management & Security			
PAP/CHAP	Yes	Yes	Yes
Callback	–	–	–
CLID	Yes	Yes	Yes
SecureID	–	–	–
Packet filtering	Yes	Yes	Yes
Dynamic Firewall Support	–	–	–
SNMP Agent	Yes	Yes	Yes
Telnet Access	Yes	Yes	Yes
Proprietary Access	Yes	Yes	Yes
TFTP Download	–	–	–
GUI Interface	Yes	Yes	Yes
Voice			
# POTS Ports	none	1	1
Incoming call preemption	n/a	–	–
Outgoing call preemption	n/a	–	–
Voice Features	n/a	–	–

ACC Congo

The ACC Congo series of ISDN products consist of three models as shown in the table to the right. They support bridging, IP routing and have an extra cost IPX routing option. The Congo fits best into a network where they will connect to other ACC products located at the network. They do not fit as well into a mixed vendor environment, especially where Ascend MAX equipment is used to support remote access to a network.

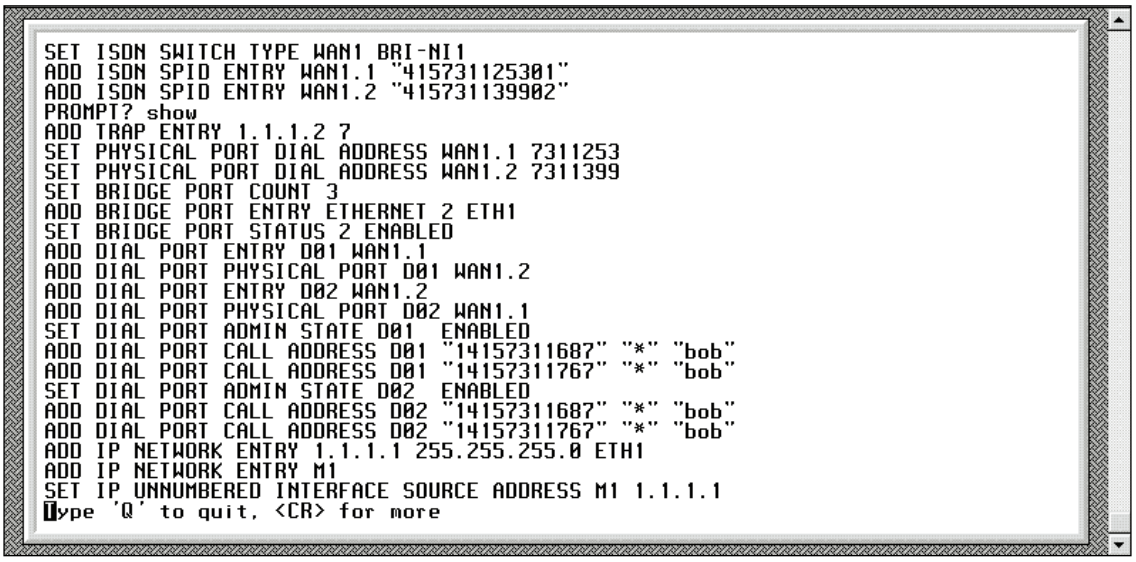
	Congo	Congo Personal Voice Router	Congo Voice Router
List Price	$845	$645	$945
# Users	unlimited	4	unlimited
Routing	Yes	Yes	Yes
Voice	–	Yes	Yes

The ACC Congos support a proprietary compression method that does not interoperate with products from other manufacturers including the Ascend MAX products. This significantly limits throughput in a mixed vendor environment. This is not an issue when communicating with other ACC products.

The Congo products do not support either BACP or MP+ which improve the operation of MP in a large network. They also do not support IP address translation that allows you to share a single-user Internet account on a network. The Congos do not support RIP routing which can simplify setup by eliminating the need to set up static routes. They do not support either callback or SecureID access security, which are required to set the highest levels of access protection.

The Congo products have a graphics interface utility called “Web Wizard” that is HTML and browser-based. Web Wizard automatically discovers the Congo on the Ethernet. You do not have to enter an IP address into the Congo to establish communications. This discovery process can be unreliable; there were times where it just did not work for us.

Web Wizard does only does a “vanilla” set up and does not provide access to all of the parameters of the unit. You have to learn and use the command line interface to do everything necessary to get the unit working in a real application. For example, Web Wizard configures the unit to make 56 Kbps calls. The “ADD DIAL PORT CALL ADDRESS” commands in the screen below must be entered to set the phone number to call, the username, the password and the speed of the connection (56 Kbps or 64 Kbps).



The screen above also shows other commands that have to be entered to set the Congo up. A basic configuration can be generated with the Web Wizard, but you will have to learn how these commands work to modify them to meet the needs of your application.

Product Test: Congo Voice Router

We tested the Congo Voice Router. The table to the right shows significant strengths and weaknesses of the ACC Congo routers relative to the Ascend Pipeline Series. The Congo works best in a network where ACC routers are used both at the central site as well as at the remote locations.

Congo Voice Router	Multi-user router
Software Version Tested	8.2.3B
Strengths: + Fits well where ACC routers when connecting to other ACC routers	
Weaknesses: – Command line interface is difficult to use – Proprietary compression significantly reduces throughput connecting to a MAX – Does not support MP or BACP – Does not support Data Over Speech Bearer Service – Does not support IP address translation or RIP – Does not support callback or SecureID access security – Firewall system not available – Software bug prevented incoming call preemption from working	

We found no significant advantages of the Congo over the Pipeline when an Ascend MAX is used at the central site. The biggest issue with the Congo is that the command line interface is difficult to use. This is less of a problem when the network is 100% ACC; however, it can significantly increase the learning curve in a mixed vendor environment.

Other issues include the lack of interoperable compression significantly reduced performance when connecting to the Ascend MAX. The Congo does not support DOSBS that can eliminate usage charges in areas where ISDN voice and data are charged differently.

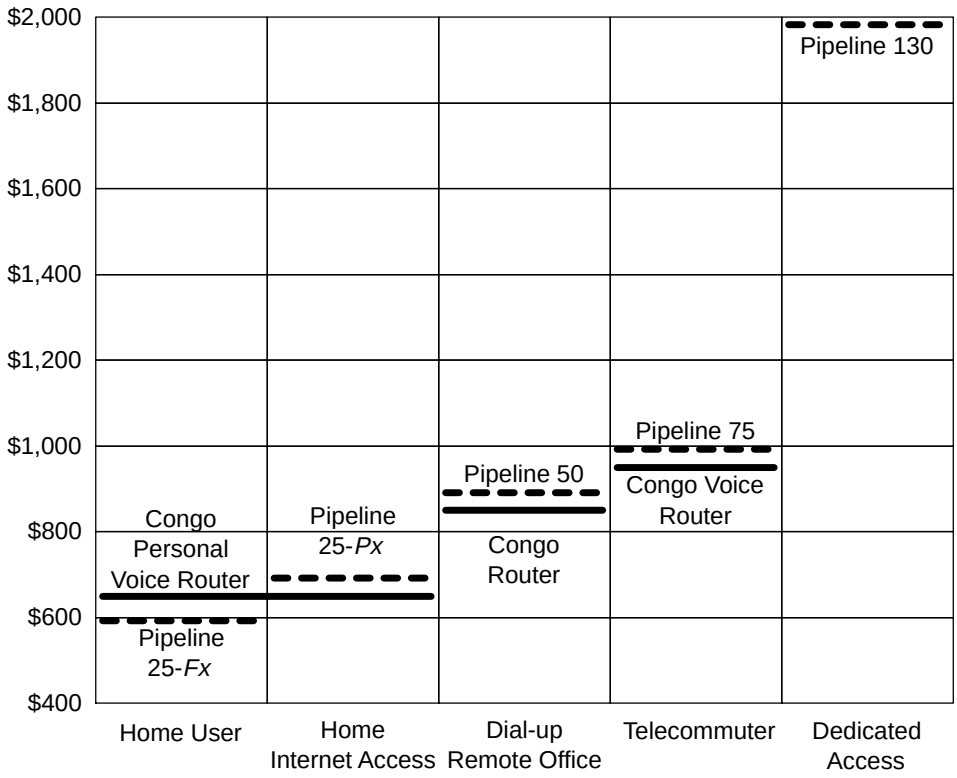
We were also not able to get incoming call preemption to work with the Version 8.2.3B software loaded into our unit. This was a software bug that ACC and provided us with a version of the software with a fix.

The Congo does not support MP+ or BACP that make supporting two B-channel, 128 Kbps, network access easier to manage on a network. It also does not support Network Address Translation that allows access to a single-user Internet account to be shared from a LAN. The Congo also does not support RIP so all routes have to be set up manually as static routes. The Congo also does not have a firewall system available with it.

We called ACC's technical support to get help with the incoming call preemption problem. The acknowledged the problem and promptly provided new software with a fix.

Product Comparison

The chart below compares the Congo series against the Ascend Pipeline Series. It shows that on a product-for-product basis. The Congo Personal Voice Router is $50 more expensive than the Pipeline 25-*Fx* and $50 less expensive than the Pipeline 25-*Px*. The Congo Router is $50 less than the Pipeline 50 and the Congo Voice Router is $50 less than the Pipeline 75. The Congo series does not include a product that competes with the Pipeline 130. ACC does have other products that do compete with the Pipeline 130.



Product Matrix

The matrix below shows a detailed analysis of the price and features of the ACC Congo products.

Company	ACC	ACC	ACC
Product	Congo	Congo Personal Voice Router	Congo Voice Router
List Price	$845	$645	$945
Hardware			
FCC Certification	Class B	Class B	Class B
S/T Interface	Yes	Yes	Yes
U Interface	Yes	Yes	Yes
Other WAN Interfaces	–	–	–
ISDN/PPP			
Local Users	unlimited	4	unlimited
DOSBS	–	–	–
MP	Yes	Yes	Yes
MP+	–	–	–
Compression	Proprietary	Proprietary	Proprietary
BACP	–	–	–
Routing			
Bridging	Yes	Yes	Yes
IP Routing	option	option	option
IP Address Xlation	–	–	–
RIP	–	–	–
IPX Routing	option	option	option
IPX Spoofing	option	option	option
Dynamic Bandwidth Allocation	Yes	Yes	Yes
# Simult. Connections	2	2	2
# Profiles	10	10	10
Management & Security			
PAP/CHAP	Yes	Yes	Yes
Callback	–	–	–
CLID	Yes	Yes	Yes
SecureID	–	–	–
Packet filtering	Yes	Yes	Yes
Dynamic Firewall Support	–	–	–
SNMP Agent	Yes	Yes	Yes
Telnet Access	Yes	Yes	Yes
Proprietary Access	–	–	–
TFTP Download	Yes	Yes	Yes
GUI Interface	Yes	Yes	Yes
Voice			
# POTS Ports	none	2	2
Incoming call preemption	n/a	Yes	Yes
Outgoing call preemption	n/a	Yes	Yes
Voice Features	n/a	–	–

ADC Kentrox Pacesetter

	Pacesetter SOHO	Pacesetter Pro
List Price	$995	$1,195
Routing	Yes	Yes
Voice	Yes	
WAN Support	–	Yes

There are two products in the ADC Kentrox ISDN product line as described in the table to the right. The Pacesetter SOHO has two POTS ports and the Pacesetter Pro has a WAN interface that support dedicated communications services. Both products support bridging, IP routing and IPX routing. The Pacesetter SOHO has two POTS ports that support voice, fax and modem devices. The Pacesetter Pro has a WAN interface that supports dedicated T1 facilities and Frame Relay.

The Pacesetter products are easy to use and have competitive feature sets. The Pacesetter Pro is very cost-effective for mixed WAN/ISDN applications, especially for Frame Relay applications.

The ADC Kentrox products use a character-based internal menu system that is easy use. At the top level you select the subject you are interested in and keep drilling down until you find the specific information you are looking for. The screen below shows the ISDN setup screen.

```
**ISDN D Channel**                                PACESETTER SOHO U Supervisor
Port 2   D Channel                          Last changed: 3/13/97 9:10:23

|- Press <RET> to toggle values -||-- Type in values.  Max chars shown in ( ) --|
Port type:   D SIGNALLING         Port name:     D Channel                (14)

Signaling type:      NI-1
                                  Directory number DN1:   5551212          (10)
X.25 support:        N                            DN2:   5551313          (10)

Incoming D over V:   64 KBPS      SPID 1:   415555121201O1                 (18)
Voice pre-empt data: ALWAYS       SPID 2:   415555131301O1                 (18)

POTS 1:              DN1
POTS 2:              DN2
Bind DNs to SPIDs:   N

                                                  Process selections (Y/N): Y
Use TAB & CURSOR keys to move among fields    Press ESC to abort command & exit
```

The Pacesetter products support only PAP/CHAP access security. They do not support higher levels of security like callback security, calling line ID screening, or SecureID type token cards. Companies requiring higher levels of access security will prefer the Pipeline series products.

The software in these units has to be upgraded using a TFTP server or client. We upgraded the software in our Pacesetter Pro using the TFTP client software in Windows NT. Windows 95 does not support TFTP so you will have to find a shareware or other TFTP client or server software to upgrade their software with this operating system.

Product Test: Pacesetter SOHO

We tested the Pacesetter SOHO. The table to the right shows the strengths and weaknesses of this product relative to the Ascend Pipeline series. The Pacesetter SOHO has a strong set of features for Internet access. One of its strengths is that it does support multiple simultaneous connections through a single-user Internet account using its Network Address Translation feature.

ADC Kentrox Pacesetter SOHO	Multi-user router
Software Version Tested	6.1
Strengths: + Easy to use + Network Address Translation supports multiple simultaneous connections	
Weaknesses: – Throughput with compression significantly less than Pipeline series products – Does not support MP+ – Does not support callback, CLID or SecureID access security – Firewall system not available – Were not able to get SOHO to answer incoming voice calls – Outgoing call preemption caused file transfer to fail.	

The biggest problems that we noted were symptoms of software instability. We found that the data transfer would fail if we had both B-channels up with a data transfer and we made an outgoing voice call from a phone connected to one of the voice ports. We were also not able to receive voice calls. ADC said this was due to the fact that our lines are not configured correctly. A protocol analyzer confirmed that the line configuration change should solve the problem, but it did appear that ADC Kentrox could solve this problem with software modifications.

We called Kentrox for technical support on these voice problems. The support people were not able to describe their ISDN configuration requirements in detail. They just said that they support the “Intel Blue” configuration. We finally found the information we were looking for in the manual on our own.

We also found a significant performance issue. The throughput of the SOHO receiving a compressible file from MAX was within 5% of the Pipeline products; however, its throughput sending the same file toward the MAX was degraded by more than 25% compared to the Pipeline products.

The Pacesetter SOHO does not support Multilink Protocol Plus which improves two B-channel operation with Ascend MAX WAN Access Switches. It supports only PAP and CHAP authentication. It does not support the higher level of access security provided by callback, Calling Line ID, or SecureID. The Pacesetter SOHO also does not support a firewall system.

Product Test: Pacesetter Pro

We also tested the Pacesetter SOHO. The table to the right shows the strengths and weaknesses of this product relative to the Ascend Pipeline series. The Pacesetter Pro is easy to set up and use and is cost-effective for WAN applications. One of its strengths is that it does support multiple simultaneous connections through a single-user Internet account using its Network Address Translation feature.

ADC Kentrox Pacesetter Pro	Multi-user router
Software Version Tested	6.0
Strengths: + Cost-effective for WAN applications, especially Frame Relay + Easy to use + Network Address Translation supports multiple simultaneous connections	
Weaknesses: – Throughput with compression less than Pipeline series products – Does not support MP+ – Does not support callback, CLID or SecureID access security – Firewall system not available – Software instability necessitated upgrade to version 6.0	

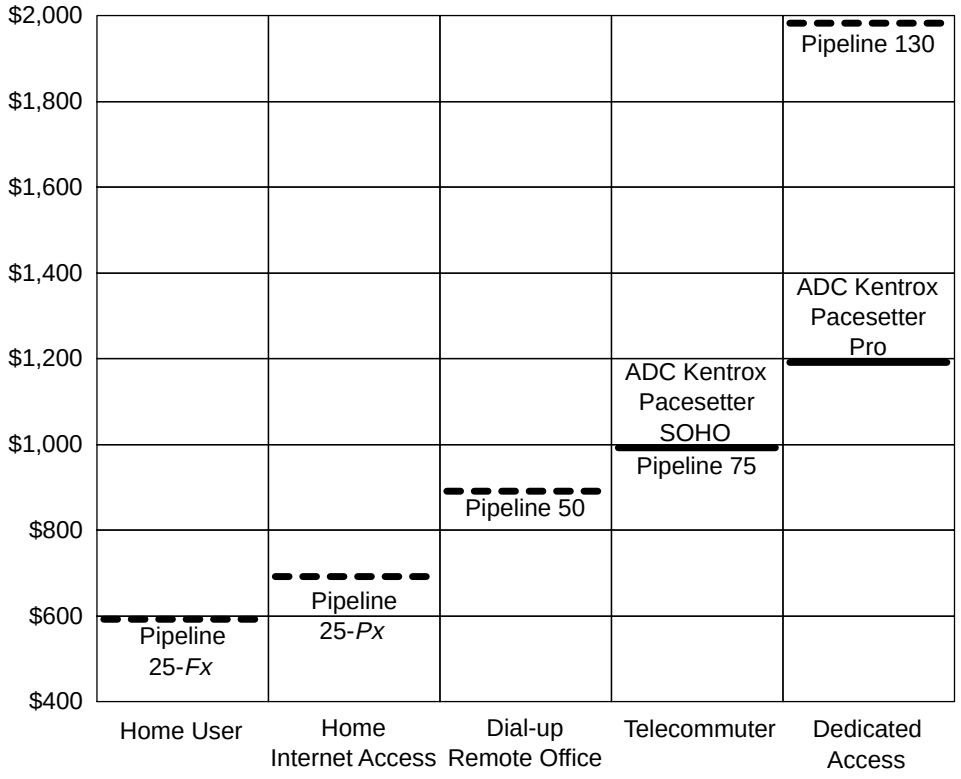
The biggest problem we ran into was that the software that came with the unit was unstable and several file transfers failed. These problems were corrected after we downloaded and installed their version 6.0 software.

Like the Pacesetter SOHO, the Pacesetter Pro has throughput issues. Again it is within 5% of the Pipeline products receiving a compressible file from the MAX; but it is degraded by about 10% in the other direction.

The Pacesetter PRO does not support MP+ which improves two B-channel operation with Ascend MAX WAN Access Switches. It supports only PAP and CHAP authentication. It does not support the higher level of access security provided by callback, Calling Line ID, or SecureID. The Pacesetter PRO also does not support a firewall system.

Product Comparison

The chart below compares the Pacesetter products to the Ascend Pipeline series. It shows that the Pacesetter SOHO is priced the exactly the same as the Ascend Pipeline 75; however the Pacesetter Pro is $700 to $800 lower in price than the Pipeline 130.



Product Matrix

The matrix below shows a detailed analysis of the price and features of the ADC Kentrox Pacesetter products.

Company	ADC Kentrox	ADC Kentrox
Product	Pacesetter SOHO	Pacesetter Pro
List Price	995	1195
Hardware		
FCC Certification	Class B	Class B
S/T Interface	Yes	Yes
U Interface	Yes	Yes
Other WAN Interfaces	–	Frame Relay
ISDN/PPP		
Local Users	unlimited	unlimited
DOSBS	Yes	Yes
MP	Yes	Yes
MP+	–	–
Compression	STAC	STAC
BACP	Yes	Yes
Routing		
Bridging	Yes	Yes
IP Routing	Yes	Yes
IP Address Xlation	Yes	Yes
RIP	Yes	Yes
IPX Routing	Yes	Yes
IPX Spoofing	Yes	Yes
Dynamic Bandwidth Allocation	Yes	Yes
# Simult. Connections	2	2
# Profiles	30	30
Management & Security		
PAP/CHAP	Yes	Yes
Callback	–	–
CLID	–	–
SecureID	–	–
Packet filtering	Yes	Yes
Dynamic Firewall Support	Yes	Yes
SNMP Agent	Yes	Yes
Telnet Access	Yes	Yes
Proprietary Access	–	–
TFTP Download	Yes	Yes
GUI Interface	–	–
Voice		
# POTS Ports	2	none
Incoming call preemption	Yes	n/a
Outgoing call preemption	Yes	n/a
Voice Features	HCDT	n/a

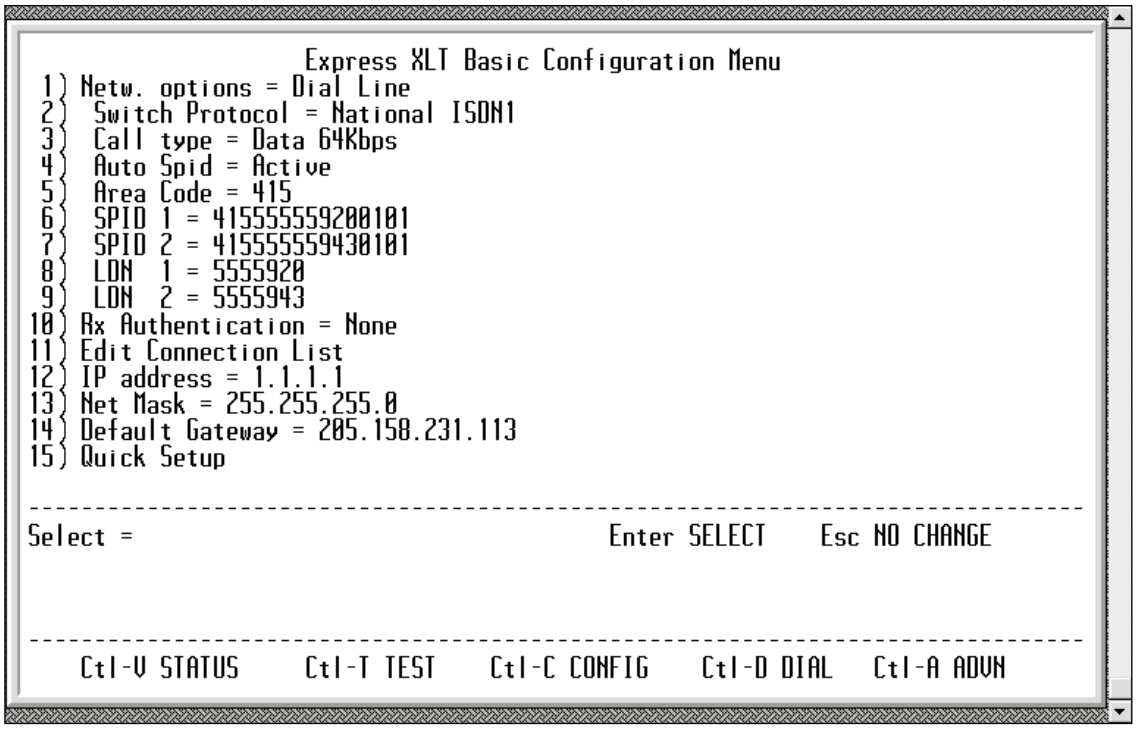
Adtran Express XL and XLT

The Adtran Express XL and XLT products are described in the table to the right. They are the same products except that the XLT includes a single POTS port. These products support bridging and IP routing. They are easy to set up and have a good set of features for IP applications.

	Express XL	Express XLT
List Price	$995	$1,095
Routing	Yes	Yes
Voice	–	Yes

The Express XL and XLT support all of the standard access security features except for callback security. The Adtran products do not support MP+ or BACP that facilitate supporting larger network remote access configurations.

The Express XL and XLT have an easy to use text-based internal user interface. You select the subject that you are interested in and drill down the specific menu that you want to work with. An example of one of its menus is given below:



You select a specific menu item by entering the line number on the left. You move between top level menus using control characters as shown in the line at the bottom of the screen.

Product Test: Express XLT

We tested the Adtran Express XLT that includes a single POTS port for voice, fax, or modem applications. The chart at the right shows its significant advantages and disadvantages compared to the Ascend Pipeline products. The Express XLT was easy to set up and it worked well as a data-only ISDN IP router.

Adtran Express XLT	Multi-user router
Software Version Tested	C.00
Strengths: + Well featured for IP networking + Easy to use	
Weaknesses: – Will connect to only one remote site at a time – prevents remote testing – Does not support MP or BACP – Does not support IPX routing – Does not support callback access security – Firewall system not available – Data transfers sometimes failed – Data transfers fail when preempted by an outgoing POTS call	

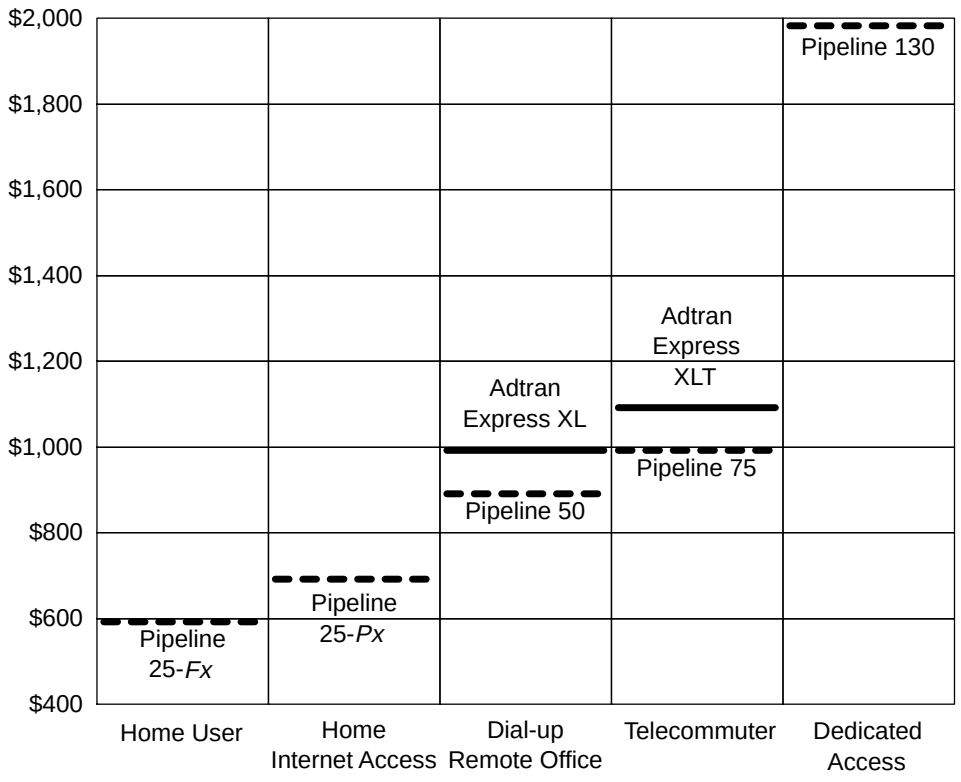
One of the most significant issues with the Express XL and XLT when compared with the Ascend Pipeline series, is that the Adtran products support connections to only one other remote site at a time. This reduces networking flexibility. It also makes it more difficult to manage because it prevents you from dialing into it and then causing it to dial to a third location. This means that you cannot remotely configure and test connection to a third location.

We experienced software instability with this product. We found that file transfers would occasionally fail and have to be restarted. We found, in particular, that file transfers would fail when a two B-channel data transfer is preempted by an outgoing POTS call from a device connected to the Phone port. A software upgrade to fix this problem should be installed before the Express XLT is used in a mixed voice/data application.

The Adtran Express XLT does not support either the MP or BACP protocols that can make it easier to support two B-channel (128 Kbps) access to a network. It also does not support IPX routing for interconnecting Novell networks.

Product Comparisons

The chart below compares the Express XL and XLT to the Ascend Pipeline series: The Adtran Express XL and XLT are each $100 more expensive than the equivalent Ascend Pipeline products.



Product Matrix

The matrix below gives a detailed analysis of the Adtran Express XL and XLT.

Company	Adtran	Adtran
Product	Express XL	Express XLT
List Price	$995	$1,095
Hardware		
FCC Certification	Class A	Class A
S/T Interface	–	–
U Interface	Yes	Yes
Other WAN Interfaces	–	–
ISDN/PPP		
Local Users	unlimited	unlimited
DOSBS	Yes	Yes
MP	Yes	Yes
MP+	–	–
Compression	STAC	STAC
BACP	–	–
Routing		
Bridging	Yes	Yes
IP Routing	Yes	Yes
IP Address Xlation	Yes	Yes
RIP	Yes	Yes
IPX Routing	–	–
IPX Spoofing	–	–
Dynamic Bandwidth Allocation	Yes	Yes
# Simult. Connections	1	1
# Profiles	15	15
Management & Security		
PAP/CHAP	Yes	Yes
Callback	–	–
CLID	Yes	Yes
SecureID	Yes	Yes
Packet filtering	Yes	Yes
Dynamic Firewall Support	–	–
SNMP Agent	Yes	Yes
Telnet Access	Yes	Yes
Proprietary Access	–	–
TFTP Download	–	–
GUI Interface	–	–
Voice		
# POTS Ports	none	1
Incoming call preemption	n/a	Yes
Outgoing call preemption	n/a	Yes
Voice Features	n/a	HCDT

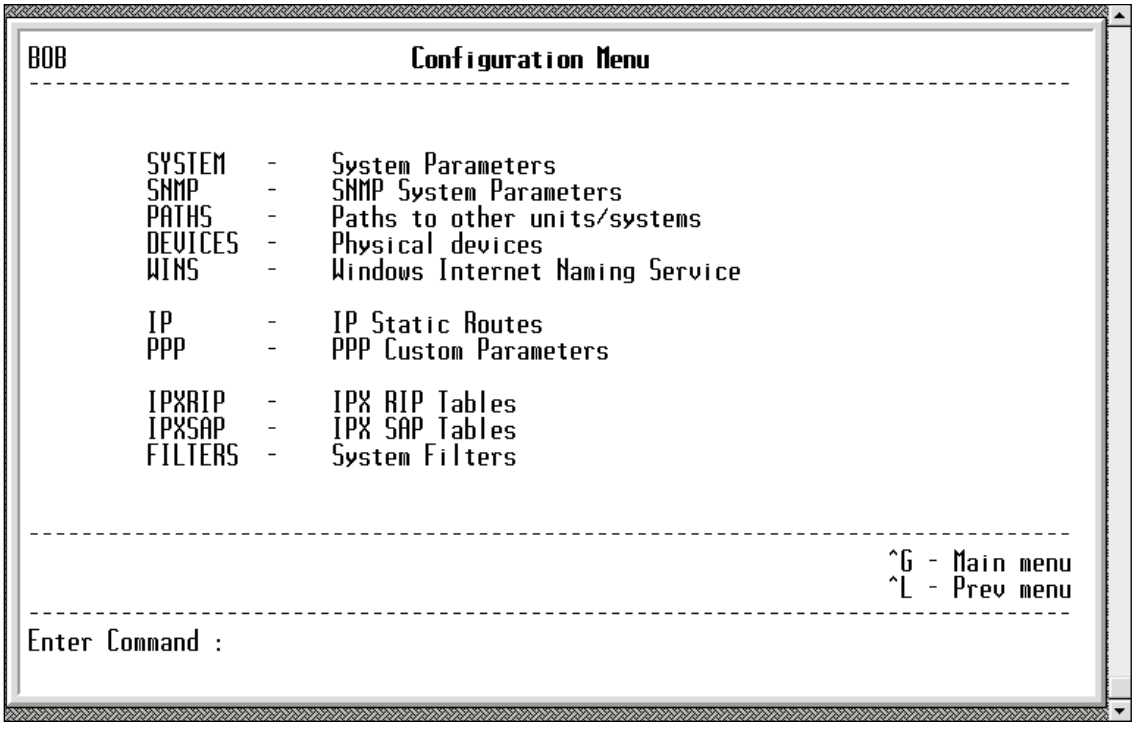
Bay Networks CLAM

	CLAM Router	Clam Voice Router
List Price	$1,195	$1,394
Routing	Yes	Yes
Voice	–	Yes

There are two Bay Networks CLAM products that do IP routing as shown in the table to the right. The CLAM routers include one model for data-only applications and another model with a single voice port. The CLAM was developed in Europe and is based on the same software base as the 3Com Office Remote products discussed earlier. Like the Office Remote the CLAM supports a large number of remote sites and is well suited to office-to-office networking. It is easy to set up the CLAM for IP or IPX routing applications.

The CLAM does not support Data Over Speech Bearer Service that can reduce usage charges where there is a difference between voice and data usage charges. The CLAM does not support the MP+ or BACP protocols that can simplify support for two B-channel (128 Kbps) access to a network. The CLAM also does not support IP Address Translation that allows a low-cost single-user Internet account to be shared by all users on a network.

The screen below shows the main configuration screen for the CLAM. Just enter the first few characters of a command and that command will be activated.



The CLAM does not support callback or token-based SecureID access security. The Pipeline products are better suited to applications that require these higher levels of security. The CLAM also does not support a dynamic firewall system.

The single voice port that is available on the CLAM Voice Router does not support either incoming or outgoing call preemption or any advanced voice features like Conference, Transfer, or Hold. The lack of incoming or outgoing call preemption makes the Ascend products more desirable for mixed voice/data applications.

The CLAM comes both in S/T-interface and U-interface models. The unit itself is really only has an S/T interface. They support the U-interface by including an external Alpha Telecom NT1 with the S/T product. The Alpha Telecom NT1 is about one-third the size of the CLAM so adds significantly to the size of the unit.

Product Test: Clam Router

We tested the data-only CLAM Router. It was easy to set up and use. We found that it would support communication with at least 20 remote sites. It provides good support for IP and IPX routing, especially for office-to-office networks.

The CLAM does not support compression that is compatible with the MAX 1800 that significantly reduces throughput transferring compressible files.

The CLAM does not support the MP or BACP protocols that can simplify supporting two B-channel (128 Kbps) connections to a network. It does not support IP Address Translation that permits a low cost, single-user Internet account to be shared on a network.

The CLAM does not support dynamic firewall software. It also does not support callback or SecureID access security that is required in the most stringent applications.

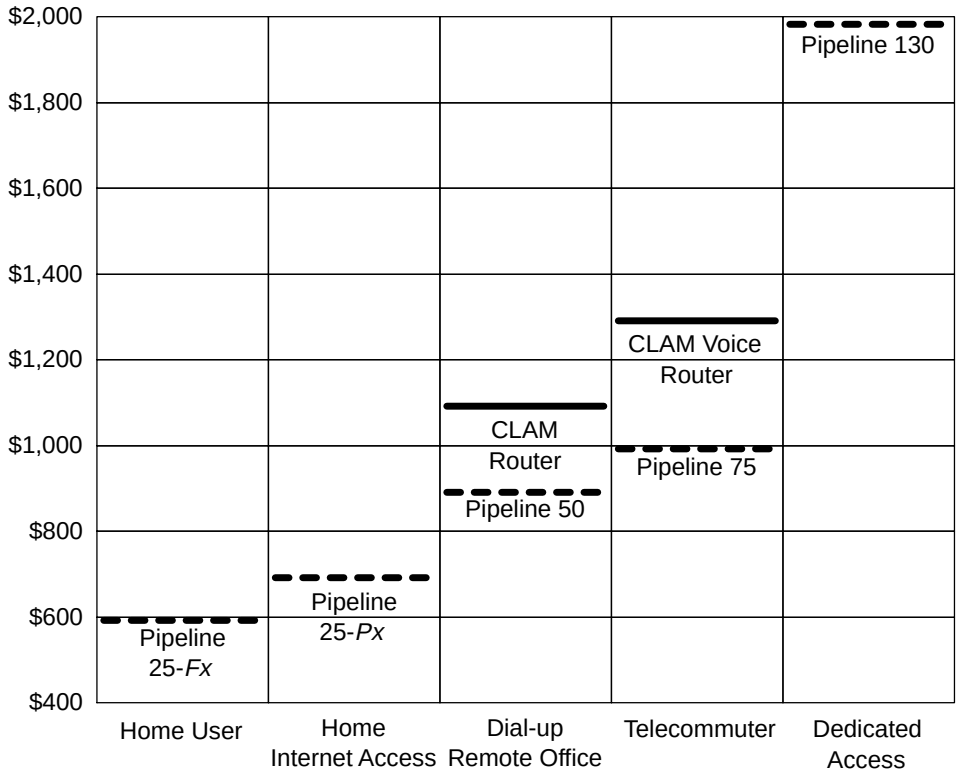
Bay Network CLAM Router	Multi-user router
Software Version Tested	1.18A
Strengths: + Full IP and IPX routing implementation + Supports a large number of remote sites + Easy to set up and use	
Weaknesses: – Does not compression compatible with the MAX 1800 which significantly reduces throughput – The CLAM uses the same method for adding and dropping second B-channel calls. This may raise usage costs – Does not support MP or BACP – Does not support IP address translation – Does not support callback or SecureID access security – Does not support a dynamic firewall – Loading new software is difficult and requires a special Ethernet driver – Loading new software is error prone and resulted in a system failure that required replacing the unit	

We had trouble upgrading our Clam Router software. Upgrading the CLAM software from a PC requires that a special virtual Ethernet driver to be installed. You then have to manually set a software interrupt vector address for the driver in the SYSTEM.INI file. After this the software load utility will work.

Even after this we were not able to use the software load utility to successfully upgrade our unit. Communications failed and the unit did not recover. It would no longer respond. We called Bay Network's support to return the unit. They made it easy and had a new unit back in two days with the appropriate software loaded into it.

Product Comparison

The table below compares the CLAM products against the Ascend Pipeline series. The CLAM Router is $300 more expensive than the Ascend Pipeline 50. The CLAM Voice Router is $400 more expensive than the Ascend Pipeline 75.



Product Matrix

The matrix below gives a detailed analysis of the Bay CLAM router products:

Company	Bay Networks	Bay Networks
Product	CLAM	CLAM
List Price	$1,195	$1,395
Hardware		
FCC Certification	Class B	Class B
S/T Interface	Yes	Yes
U Interface	Yes	Yes
Other WAN Interfaces	–	–
ISDN/PPP		
Local Users	unlimited	unlimited
DOSBS	–	–
MP	Yes	Yes
MP+	–	–
Compression	STAC	STAC
BACP	–	–
Routing		
Bridging	Yes	Yes
IP Routing	Yes	Yes
IP Address Xlation	–	–
RIP	Yes	Yes
IPX Routing	Yes	Yes
IPX Spoofing	Yes	Yes
Dynamic Bandwidth Allocation	Yes	Yes
# Simult. Connections	2	2
# Profiles	20+	20+
Management & Security		
PAP/CHAP	Yes	Yes
Callback	–	–
CLID	Yes	Yes
SecureID	–	–
Packet filtering	Yes	Yes
Dynamic Firewall Support	–	–
SNMP Agent	Yes	Yes
Telnet Access	Yes	Yes
Proprietary Access	–	–
TFTP Download	–	–
GUI Interface	–	–
Voice		
# POTS Ports	none	1
Incoming call preemption	n/a	–
Outgoing call preemption	n/a	–
Voice Features	n/a	–

Cisco 600, 700, 1000, 2500 Series

Cisco has three lines of ISDN client routers. The 700 series are products that came with their acquisition of Combinet in 1995. The 1003 and 1004 are small ISDN routers that use Cisco's IOS routing software. The 2500 is a full Cisco high-end router and also uses the IOS routing software. The table to the right shows the characteristics of the IOS routers. The 700 series use software originally developed at Combinet. All three of these products support a full set of routing capabilities.

	1003	1004	2503
List Price	$1,595	$1,795	$2,895
Interface	S/T	U	S/T
Routing	Yes	Yes	Yes
WAN Support	–	–	Yes

	761	762	765	766
List Price	$899	$949	$1,049	$1,099
10Base-T	Yes	Yes	Yes	Yes
4 Port Hub	–	–	–	–
Interface	S/T	U	S/T	U
Routing	Yes	Yes	Yes	Yes
Voice	–	–	Yes	Yes

	771	772	775	776
List Price	$1,049	$1,099	$1,199	$1,249
10Base-T	–	–	–	–
4 Port Hub	Yes	Yes	Yes	Yes
Interface	S/T	U	S/T	U
Routing	Yes	Yes	Yes	Yes
Voice	–	–	Yes	Yes

The 1003, 1004 and 2500 IOS-based routers are strong products. IOS is the leading routing software in the industry today. These products will be attractive to the network specialists who are already very familiar with IOS products.

The second and third tables above show the characteristics of the Cisco 760 and 770 series of products. The prices in these tables show the prices for units with the hardware, the routing software, and compression. The 760 series has a single LAN interface. The 770 series replaces this single LAN interface with a four port Ethernet hub.

The 760 and 770 series products include a full implementation of both IP and IPX routing. Even though they do not support IOS, they will be attractive to organizations that are inclined to stay within the Cisco product line.

All of these products use command line interfaces and are difficult to learn and to use. This will be more of an issue with end-users that are not familiar with Cisco's high-end products than it will be with the network specialists responsible for operating Cisco-based networks. The Product Test sections below describe these user interface issues in more detail.

We had to call Cisco's technical support for problems with both the 2503 and the 1004 that we tested. The main problem was the time that it took to talk to a support person. Once we did get in touch with the support person we found that they were quite willing to spend extended amounts of time on the phone to resolve the problem. The quality of support was uneven. In one case the support person was able to identify and resolve the problem quickly. In the other case it took more time.

Cisco does not make their software updates freely available to the public. This means that you have to work through their support staff get an upgrade. They also do have a number of extra-cost support plans. We ended up subscribing to one of these when we returned the 1004. Under this plan they shipped the new unit out immediately and did not wait until they received the unit to be replaced.

Product Test: 2503

The table to the right shows the strengths and weaknesses of the Cisco 2503 relative to the Ascend Pipeline series of products.

Cisco 2503	Multi-user router
Software Version Tested	IOS 11.0(11)
Strengths: + Supports Cisco's IOS routing software + Strong routing capabilities + Strong WAN support including Frame Relay	
Weaknesses: – Command line interface is difficult to learn and use – Compression will not interoperate with the Ascend MAX – significantly limits throughput. – Does not support MP+ or BACP – Does not support SecureID access security – Firewall system not available – Software delivered with unit – IOS 11.0(2) – would not support PPP MP interoperation with the Ascend MAX. Had to upgrade to 11.0(11). – Software upgrade requires TFTP server software	

The 2503 is a mainstream IOS product and will be attractive to the many organizations using Cisco routers in their WAN backbone. The 2503 supports all of the WAN and routing protocols that are available in IOS.

The IOS products, like the 2503, are targeted toward the sophisticated WAN network manager, not the naïve end-user. They are difficult to use for those people who have not developed IOS expertise with other Cisco products. The Ascend Pipeline products are much easier to set up and to use, especially by end-users.

Cisco's compression is not interoperable with the Ascend MAX products. This means that the throughput of the 2503 with Ascend MAX products is well below that achieved by the Pipeline products with compressible files.

We ran into a bug that prevented the 2503's PPP Multilink Protocol from working with the Ascend MAX using the IOS version 11.0(2) delivered with the unit. We had to upgrade the software to IOS version 11.0(11) to get MP to work. Upgrading the software in the 2503 requires TFTP server software. We downloaded a Windows NT shareware TFTP server to accomplish the software load. You cannot download software into the 2503 through the serial port.

```
!
interface BRI0
 ip unnumbered Ethernet0
 encapsulation ppp
 isdn spid1 415731125301
 isdn spid2 415731139902
 dialer idle-timeout 600
 dialer map ip 215.228.132.1 name MAX1800 14155555687
 dialer map ip 215.228.132.1 name MAX1800 14155555767
 dialer load-threshold 32 either
 dialer-group 1
 no fair-queue
 ppp multilink
 ppp authentication pap callin
!
router igrp 1
 network 1.0.0.0
!
ip route 215.228.132.0 255.255.255.0 215.228.132.1
ip route 215.228.132.1 255.255.255.255 BRI0
access-list 1 permit any
dialer-list 1 protocol ip list 1
!
 --More--
```

IOS uses a complex, command oriented user interface. The documentation comes on a CD-ROM and it takes time to find what you need. We had to call Cisco's technical support to set the configuration up correctly. The screen above shows some of the commands needed to set up the 2503 to communicate with the MAX using ISDN:

The 2503 does not support MP+ or BACP which are different ways to improve the ability to support two B-channel (128 Kbps) access to a network. It does not support SecureID token card access control, which is used by those demanding the highest level of access security.

Product Test: 1004

The table to the right gives the strengths and weaknesses of the Cisco 1004 relative to the Ascend Pipeline series of products.

Cisco 1004	Multi-user router
Software Version Tested:	IOS 11.0(11)
Strengths: + Uses Cisco's IOS routing software + Strong routing capabilities	
Weaknesses: – Command line interface is difficult to learn and use – Compression will not interoperate with the Ascend MAX – significantly limits throughput. – Does not support MP+ or BACP – Does not support SecureID access security – Firewall system not available – Software delivered with unit – IOS 11.0(4) – would not support PPP MP interoperation with the Ascend MAX. Had to upgrade to 11.0(11).	

The 1004 is based on the IOS routing software and will be attractive to organizations using other Cisco IOS routers in their network.

The 1004, like the 2503, is targeted toward the sophisticated WAN network manager, not the naïve end-user. They are difficult to use for those people who have not developed IOS expertise with other Cisco products. The Ascend Pipeline products are much easier to set up and to use, especially by most users.

Cisco's compression is not interoperable with the Ascend MAX products. This means that the throughput of the 2503 with Ascend MAX products is well below that achieved by the Pipeline products with compressible files.

We were not able to get the MP to work with the Ascend MAX using the IOS version 11.0(4) delivered with the 2503. We had to upgrade the software to IOS version 11.0(11) to get MP to work.

We used a shareware TFTP server to upgrade the software in the 1004. There is a download utility that comes with the 1004 that uses a combination of the serial port and the Ethernet interface. The original version of this software had bugs and had to be upgraded. In the interest of time we used the TFTP approach to upgrade the unit.

The 1004 does not support MP+ or BACP which are different ways to improve the ability to support two B-channel (128 Kbps) access to a network. It does not support SecureID token card access control, which is used by those demanding the highest level of access security.

IOS uses a complex, command oriented user interface. The documentation comes on a CD-ROM and

it takes time to find what you need to get it to work. We had to call Cisco's technical support to figure out how to set the configuration up correctly. The screen below shows some of the commands needed to set up the 1004 to communicate with the MAX using ISDN:

Product Test: 766

```
interface Ethernet0
 ip address 1.1.1.1 255.255.255.0
!
interface BRI0
 ip unnumbered Ethernet0
 encapsulation ppp
 dialer idle-timeout 600
 dialer map ip 205.158.231.113 name MAX1800 14155555687
 dialer map ip 205.158.231.113 name MAX1800 14155555767
 dialer load-threshold 32 either
 dialer-group 1
 isdn spid1 415731125301 7311253
 isdn spid2 415731139902 7311399
 no fair-queue
 ppp multilink
!
router igrp 1
 network 1.0.0.0
!
ip route 215.228.132.0 255.255.255.0 215.228.132.1
ip route 215.228.132.1 255.255.255.255 BRI0
access-list 1 permit any
dialer-list 1 protocol ip list 1
 --More--
```

The table to the right gives the strengths and weaknesses of the Cisco 766 when compared against the Ascend Pipeline series. The software in the 700 series is derived from the Combinet products that Cisco acquired in 1995 and has nothing in common with IOS.

Cisco 766	Multi-user router
Software Version Tested:	3.2(5)
Strengths: + Good IP and IPX routing support + Integrates well with Cisco routers used to support network access + Network Address Translation supports multiple simultaneous connections	
Weaknesses: – Command line interface is difficult to learn and use – Compression will not interoperate with the Ascend MAX – significantly limits throughput. – Does not support MP+ or BACP – Does not support SecureID access security – Firewall system not available	

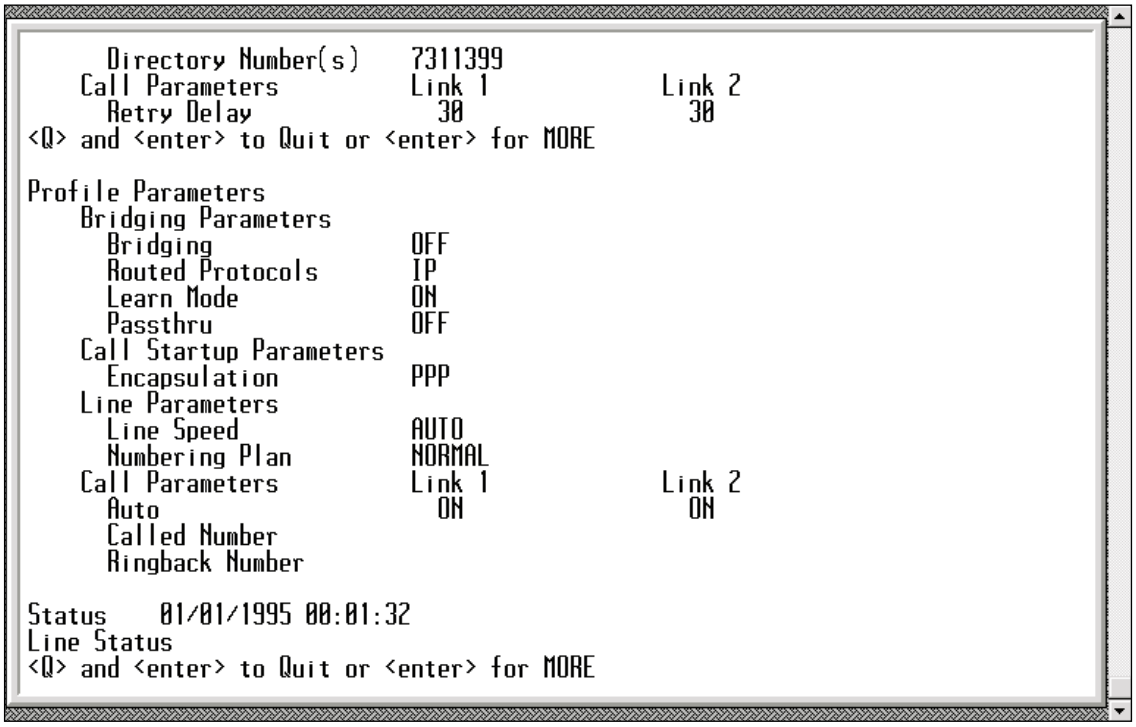
The 766 comes with strong IP and IPX routing software. They have been designed to integrate well with Cisco routers used to support remote network access. One of its strengths is that it does support multiple simultaneous connections through a single-user Internet account using its Network Address Translation feature.

The 766 comes with bridging, IP routing and IPX routing software. The unit we tested did not support compression that is compatible with the Ascend MAX, which significantly reduced its throughput on compressible files. It did support a full set of access security options except that it does not support SecureID token cards that is used in the most demanding applications.

The 766 does not support MP+ or BACP which are different ways to improve the ability to support two B-channel (128 Kbps) access to a network.

The 766 also includes two POTS and supports preemption of data calls by both incoming and outgoing voice calls. It does support call waiting and hold supplementary services.

The Cisco 700 series does come with a Clickstart utility to assist in the initial set up. We found that the Clickstart utility would not fully configure the unit. We had to go in and modify or enhance the configurations created by Clickstart to get the unit to work, even in a simple IP environment. The command interface is complex and difficult to learn. It is less friendly than the Ascend Pipeline products. The screen below shows a part of a status screen. Each of the parameters shown has to be set or modified with its own command:

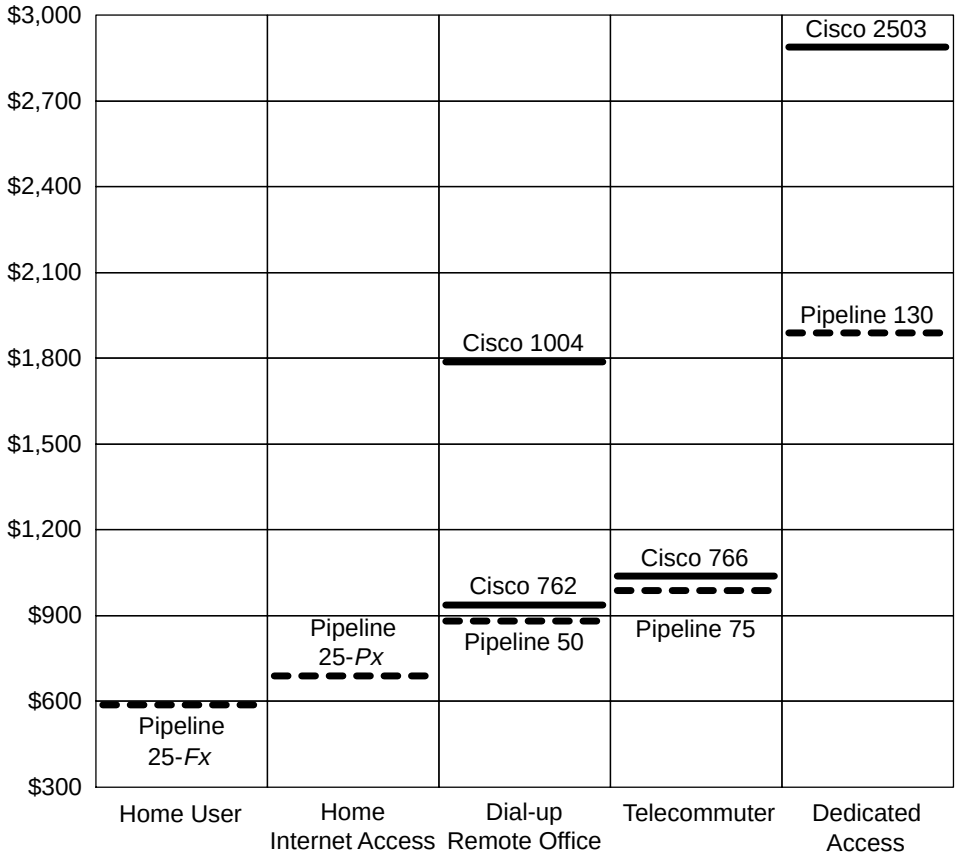


```
      Directory Number(s)    7311399
    Call Parameters          Link 1              Link 2
      Retry Delay              30                  30
<Q> and <enter> to Quit or <enter> for MORE

Profile Parameters
    Bridging Parameters
      Bridging               OFF
      Routed Protocols       IP
      Learn Mode             ON
      Passthru               OFF
    Call Startup Parameters
      Encapsulation          PPP
    Line Parameters
      Line Speed             AUTO
      Numbering Plan         NORMAL
    Call Parameters          Link 1              Link 2
      Auto                     ON                  ON
      Called Number
      Ringback Number

Status    01/01/1995 00:01:32
Line Status
<Q> and <enter> to Quit or <enter> for MORE
```

Product Comparison

The chart below compares the Cisco products with the Ascend Pipeline series of products. Only the U-interface 76x products are shown. You can subtract $50 to get the price of the S/T interface products. You can add $150 to get the price of the equivalent 77x products:

The 762 is $50 more expensive than the Pipeline 50 and the 766 is $1,000 more expensive than the Pipeline 75. The Cisco 1004 is $900 more expensive than the Pipeline 50. The Cisco 2503 is at lest $900 more expensive than the Pipeline 130.



Product Matrix

On the next two pages are matrices that shows the detail characteristics of the Cisco products. All prices are for the versions that support an unlimited number of users and includes IP routing and compression.

Company	Cisco	Cisco	Cisco	Cisco	Cisco	Cisco	Cisco	Cisco
Product	761	762	765	766	771	772	775	776
List Price	$899	$949	$1,049	$1,099	$1,049	$1,099	$1,199	$1,249
Hardware								
FCC Certification	Class B	Class B	Class B	Class B	Class B	Class B	Class B	Class B
S/T Interface	Yes	–	Yes	–	Yes	–	Yes	–
U Interface	–	Yes	–	Yes	–	Yes	–	Yes
Other WAN Interfaces	–	–	–	–	–	–	–	–
ISDN/PPP								
Local Users	4 or 1500	4 or 1500	4 or 1500	4 or 1500	4 or 1500	4 or 1500	4 or 1500	4 or 1500
DOSBS	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MP	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MP+	–	–	–	–	–	–	–	–
Compression	–	–	–	–	–	–	–	–
BACP	–	–	–	–	–	–	–	–
Routing								
Bridging	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IP Routing	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IP Address Xlation	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
RIP	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IPX Routing	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IPX Spoofing	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dynamic Bandwidth Allocation	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# Simult. Connections	2	2	2	2	2	2	2	2
# Profiles	17	17	17	17	17	17	17	17
Management & Security								
PAP/CHAP	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Callback	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CLID	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SecureID	–	–	–	–	–	–	–	–
Packet filtering	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dynamic Firewall Support	–	–	–	–	–	–	–	–
SNMP Agent	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Telnet Access	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Proprietary Access	–	–	–	–	–	–	–	–
TFTP Download	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GUI Interface	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Voice								
# POTS Ports	none	none	2	2	none	none	2	2
Incoming call preemption	n/a	n/a	Yes	Yes	n/a	n/a	Yes	Yes
Outgoing call preemption	n/a	n/a	Yes	Yes	n/a	n/a	Yes	Yes
Voice Features	n/a	n/a	CW. Hold	CW. Hold	n/a	n/a	CW. Hold	CW. Hold

Company	Cisco	Cisco	Cisco
Product	1003	1004	2503
List Price	$1,595	$1,795	$2,895
Hardware			
FCC Certification	Class B	Class B	Class A
S/T Interface	Yes	–	Yes
U Interface	–	Yes	–
Other WAN Interfaces	–	–	2-Frame Relay, T1/DDS56
ISDN/PPP			
Local Users	unlimited	unlimited	unlimited
DOSBS	Yes	Yes	Yes
MP	Yes	Yes	Yes
MP+	–	–	–
Compression	STAC	STAC	STAC, Predictor
BACP	–	–	–
Routing			
Bridging	Yes	Yes	Yes
IP Routing	Yes	Yes	Yes
IP Address Xlation	Yes	Yes	Yes
RIP	Yes	Yes	Yes
IPX Routing	Yes	Yes	Yes
IPX Spoofing	option	option	Yes
Dynamic Bandwidth Allocation	Yes	Yes	Yes
# Simult. Connections	2	2	2
# Profiles	20+	20+	20+
Management & Security			
PAP/CHAP	Yes	Yes	Yes
Callback	Yes	Yes	Yes
CLID	Yes	Yes	Yes
SecureID	–	–	–
Packet filtering	Yes	Yes	Yes
Dynamic Firewall Support	–	–	–
SNMP Agent	Yes	Yes	Yes
Telnet Access	Yes	Yes	Yes
Proprietary Access	–	–	–
TFTP Download	Yes	Yes	Yes
GUI Interface	–	–	–
Voice			
# POTS Ports	none	none	none
Incoming call preemption	n/a	n/a	n/a
Outgoing call preemption	n/a	n/a	n/a
Voice Features	n/a	n/a	n/a

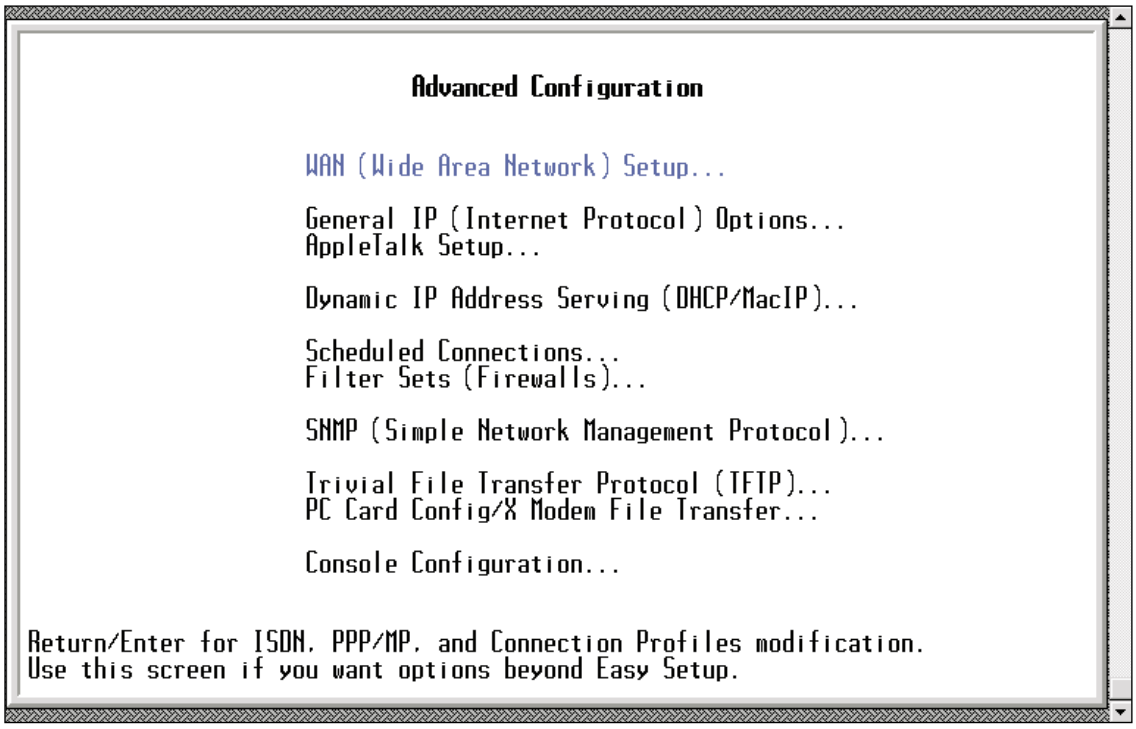
Farallon Netopia

The Farallon Netopia series of routers consists of five models as shown in the table below. They support all support IP and IPX routing. The 400 series are targeted to the Apple market and these products support AppleTalk, The 600 series products are targeted to the PC market and support only IP and IPX routing. The Farallon products do not support bridging so they can only be used for the protocols that they actually route.

	Netopia 435	Netopia 440	Netopia 630	Netopia 635	Netopia 640
List Price	$1,375	$1,375	$935	$1,095	$1,095
# Users	5	Unlimited	12	Unlimited	Unlimited
IP/IPX Routing	Yes	Yes	Yes	Yes	Yes
AppleTalk Routing	Yes	Yes	–	–	–
Voice	Yes	–	–	Yes	–

The Farallon products are easy to set up and are well suited to IP and AppleTalk applications. One of its strengths is that it does support multiple simultaneous connections through a single-user Internet account using its Network Address Translation feature.

The 435, 635, and 640 come with a browser based setup program. We found that it can be used to set up a basic configuration, but most users will want features like MP that are not available from this utility. The Netopia products include a character-based menu system that is not difficult to use. We ended up using the internal character-based menu to support our testing.



Product Test: Netopia 440

We tested the Netopia 440 from a PC using IP routing into the Ascend MAX 440. The table to the right shows the strengths and weaknesses of the Netopia 440 compared to the Ascend Pipeline products. The Netopia 440 does support AppleTalk routing; whereas the Pipeline products bridge AppleTalk. The 440 is easy to set up and use. One of its strengths is that it does support multiple simultaneous connections through a single-user Internet account using its Network Address Translation feature.

Netopia 440	Multi-user router
Software Version Tested:	1.1.1
Strengths: + Includes AppleTalk routing + Easy to use + Network Address Translation supports multiple simultaneous connections	
Weaknesses: – Lack of bridging means it will support only the protocols it routes – 35% performance degradation sending files toward the Ascend MAX – Does not support Data Over Speech Bearer Service – Does not support MP+ or BACP – Does not support Calling Line ID or SecureID access security – Does not have firewall support	

We did see a 35% performance degradation in transferring files toward the Ascend MAX with the 440 running the 1.1.1 version software.

The 440 does not support Data Over Speech Bearer Service which is a real advantage where there is a difference between usage charges for ISDN voice and ISDN data services.

The 440 does not support MP+ or BACP which improve your ability to support two B-channel (128 Kbps) access to a network. It does not support either Calling Line ID or SecureID access security. The 440 also do not have any firewall support.

Product Test: Netopia 635

We also tested the Netopia 635 into the Ascend MAX 1800. The table to the right shows the strengths and weaknesses of the Netopia 635 compared to the Ascend Pipeline products. The 635 is easy to set up and use. One of its strengths is that it does support multiple simultaneous connections through a single-user Internet account using its Network Address Translation feature.

Netopia 635	Multi-user router
Software Version Tested:	2.0
Strengths: + Easy to use + Network Address Translation supports multiple simultaneous connections	
Weaknesses: – Lack of bridging means it will support only the protocols it routes – Does not support Data Over Speech Bearer Service – Does not support MP+ or BACP – Does not support Calling Line ID or SecureID access security – Does not have firewall support	

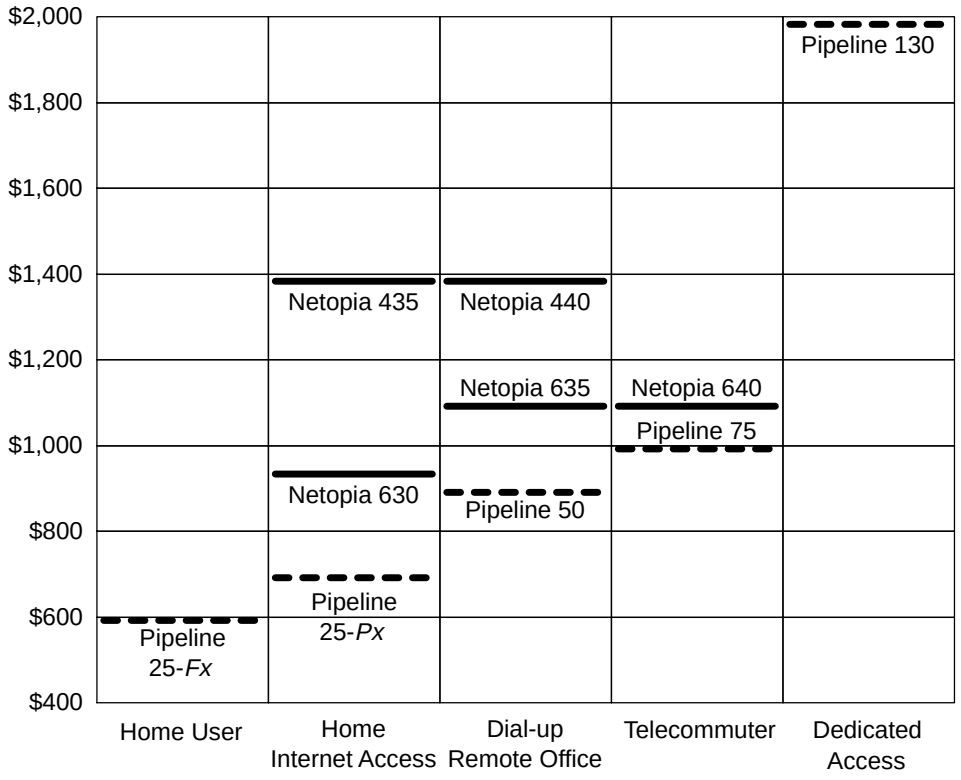
Both the Netopia products do not include bridging support, so they will not support any protocols that they cannot route.

The 635 does not support Data Over Speech Bearer Service which is a real advantage where there is a difference between usage charges for ISDN voice and ISDN data services.

The 635 does not support MP+ or BACP which improve your ability to support two B-channel (128 Kbps) access to a network. It does not support either Calling Line ID or SecureID access security. The 635 also do not have any firewall support.

Product Comparison

The chart below compares the Netopia products against the Ascend Pipeline series. The 435 is limited to five users and has two POTS ports and includes AppleTalk routing. The 435 is nearly $700 more expensive than the Pipeline 25-*Px*. The 440 also supports AppleTalk routing without POTS ports and is nearly $500 more expensive than the Ascend Pipeline 50. The 630, the 635, and the 640 are closer in functionality to the Ascend products since they do not support AppleTalk routing. The 630 is $240 more expensive than the Pipeline 25-*Px*, 635 is $200 more expensive than the Pipeline 50, and the 640 is $100 more expensive than the Pipeline 75.



Product Matrix

The matrix on the next page shows a detailed analysis of the price and features of the Farallon Netopia series of products.

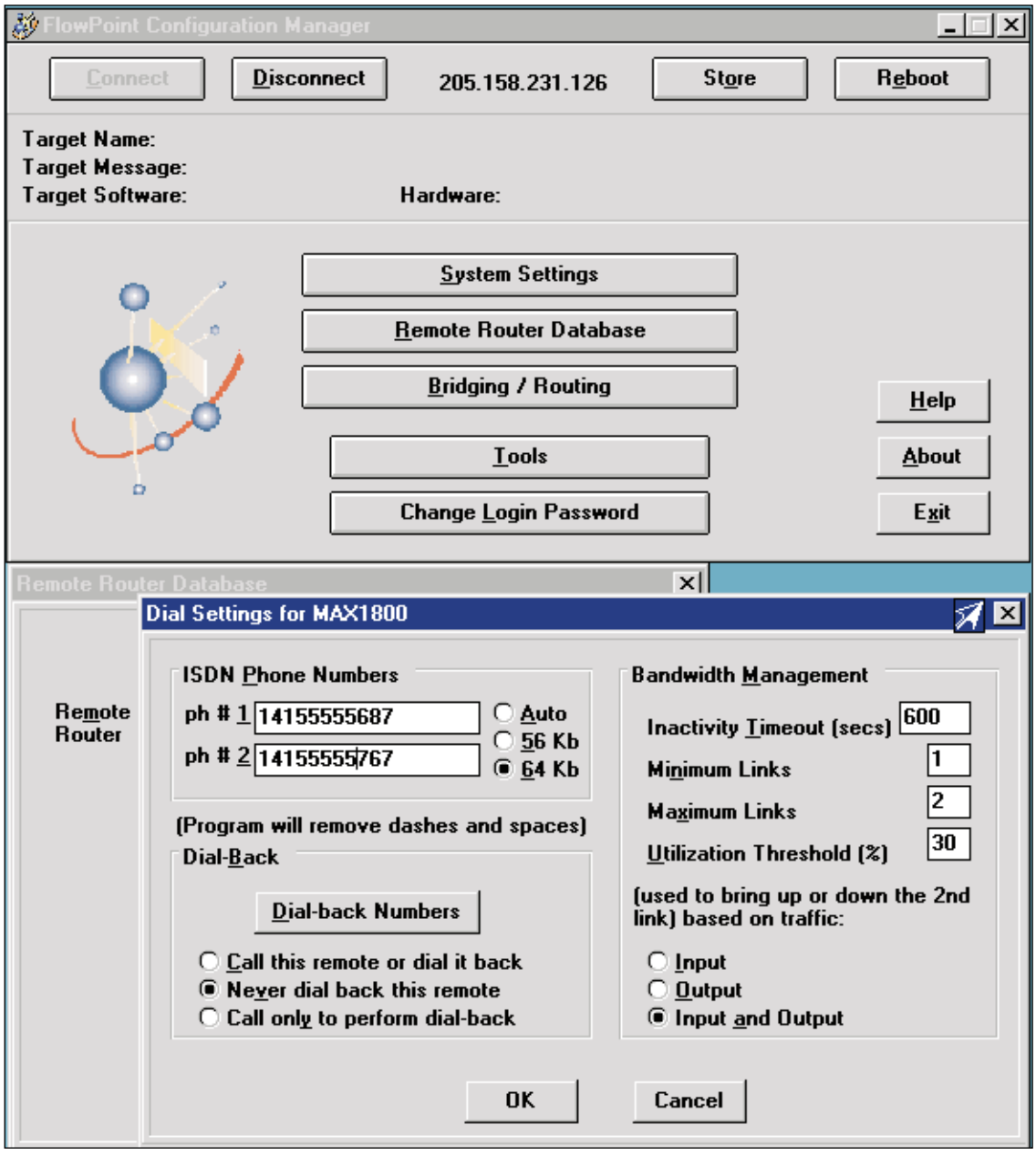
Company	Farallon	Farallon	Farallon	Farallon	Farallon
Product	Netopia 435	Netopia 440	Netopia 630	Netopia 635	Netopia 640
List Price	$1,375	$1,375	$935	$1,095	$1,095
Hardware					
FCC Certification	Class A	Class A	Class A	Class A	Class A
S/T Interface	–	–	–	–	–
U Interface	Yes	Yes	Yes	Yes	Yes
Other WAN Interfaces	–	–	–	–	–
ISDN/PPP					
Local Users	5	unlimited	12	unlimited	unlimited
DOSBS	–	–	–	–	–
MP	Yes	Yes	Yes	Yes	Yes
MP+	–	–	–	–	–
Compression	STAC	STAC	STAC	STAC	STAC
BACP	–	–	–	–	–
Routing					
Bridging	–	–	–	–	–
IP Routing	Yes	Yes	Yes	Yes	Yes
IP Address Xlation	Yes	Yes	Yes	Yes	Yes
RIP	Yes	Yes	Yes	Yes	Yes
IPX Routing	Yes	Yes	Yes	Yes	Yes
IPX Spoofing	–	–	–	–	–
Dynamic Bandwidth Allocation	Yes	Yes	Yes	Yes	Yes
# Simult. Connections	2	2	2	2	2
# Profiles	16	16	16	16	16
Management & Security					
PAP/CHAP	Yes	Yes	Yes	Yes	Yes
Callback	Yes	Yes	Yes	Yes	Yes
CLID	–	–	–	–	–
SecureID	–	–	–	–	–
Packet filtering	Yes	Yes	Yes	Yes	Yes
Dynamic Firewall Support	–	–	–	–	–
SNMP Agent	Yes	Yes	Yes	Yes	Yes
Telnet Access	Yes	Yes	Yes	Yes	Yes
Proprietary Access	–	–	–	–	–
TFTP Download	Yes	Yes	Yes	Yes	Yes
GUI Interface	Yes	–	–	Yes	Yes
Voice					
# POTS Ports	2	none	none	2	none
Incoming call preemption	Yes	n/a	n/a	Yes	n/a
Outgoing call preemption	Yes	n/a	n/a	Yes	n/a
Voice Features	CLID	n/a	n/a	CLID	n/a

Flowpoint 100

	120-H	120-O	122-H	122-O
List Price	$795	$895	$895	$995
# Users	8	unlimited	8	unlimited
Routing	Yes	Yes	Yes	Yes
Voice	–	–	Yes	Yes

The Flowpoint product line consists of four models as shown in the table to the right. The S/T-interface products are targeted primarily to international markets and the U-interface products are targeted to the U.S. market. Flowpoint is one of only two companies beyond Ascend whose products support all of the basic criteria outlined in Chapter 1 – MP support, compression, and a fully functional graphics interface configuration utility.

The Flowpoint products are well suited to IP and IPX routing applications. They have an attractive and useful graphics based setup utility program. They are also priced competitively.



The Flowpoint products use a graphics user interface utility that can be effectively used to set up and operate the unit. This utility does not automatically discover the Flowpoint router on the Ethernet. You first have to enter an Ethernet address and subnet mask into the router first. You can do this using a terminal emulator or via the POTS port, if it exists. The screen below shows the main screen, a small part of the remote router screen and the dial setting screens that shows a specific remote dialup site.

The 122-O does not support MP+ or BACP which improve your ability to support two B-channel (128 Kbps) access to a network. It does not support either Calling Line ID or SecureID access security.

The graphic-based user interface utility does not support packet filtering. It is necessary to use the command line interface to configure bridging filters. These products do support a rudimentary firewall that discards packets received from the WAN that have a source IP address recognized as a local LAN address.

Product Test: Flowpoint 122-O

We tested the Flowpoint 122-O. The figure to the right shows the significant strengths and weaknesses of the Flowpoint 122-O compared to the Pipeline product line. We found that the second B-channel is controlled only by traffic levels. It comes down quickly once traffic level drops below a specified level. If your traffic is erratic, this can increase usage charges, especially where the first minute costs significantly higher than subsequent minutes.

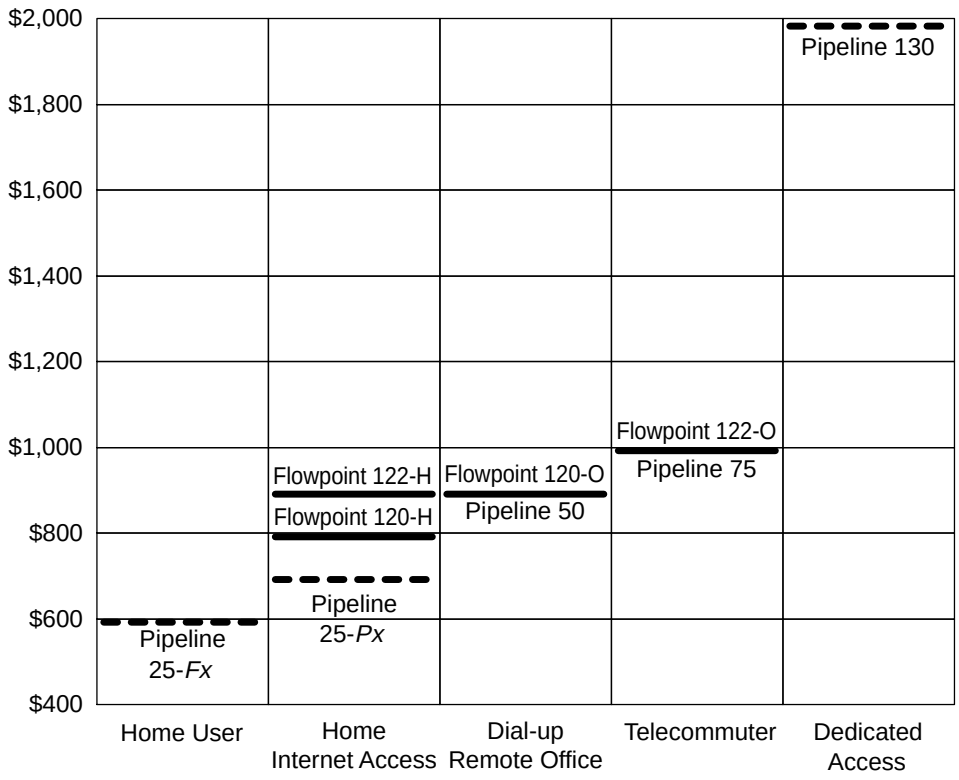
The 122-O does not support Data Over Speech Bearer Service, which is a real advantage where there is a difference between usage charges for ISDN voice, and ISDN data services.

We found that the Flowpoint would not support incoming call preemption with its version 028-04 software. The Ascend Pipeline 25 and 75 are better choices if you want to interrupt data traffic to handle incoming voice calls.

Flowpoint 120-O	Multi-user router
Software Version Tested:	028-04
Strengths: + Easy to use Graphics User Interface configuration utility + Good IP and IPX routing support + Competitive pricing	
Weaknesses: – The Flowpoint drops the second B-channel very quickly and will increase usage charges – Does not support Data Over Speech Bearer Service – Does not support MP+ or BACP – Does not support Calling Line ID or SecureID access security – Limited firewall support – The Flowpoint does not support incoming call preemption	

Product Comparison

The chart below compares the Flowpoint products against the Ascend Pipeline series. The Flowpoint 120-H and 122-H products support 8 users and are $100 to $200 more expensive than the Pipeline 25 products. The Flowpoint 120-O and 122-O are priced the same as the Ascend Pipeline 50 and 75 respectively.



Product Matrix

The matrix on the next page shows a detailed analysis of the price and features of the Flowpoint 100 products.

Company	Flowpoint	Flowpoint	Flowpoint	Flowpoint
Product	Flowpoint 120-H	Flowpoint 120-O	Flowpoint 122-H	Flowpoint 122-O
List Price	$795	$895	$895	$995
Hardware				
FCC Certification	Class B	Class B	Class B	Class B
S/T Interface	both	both	both	both
U Interface	both	both	both	both
Other WAN Interfaces	–	–	–	–
ISDN/PPP				
Local Users	8	unlimited	8	unlimited
DOSBS	–	–	–	–
MP	Yes	Yes	Yes	Yes
MP+	–	–	–	–
Compression	STAC	STAC	STAC	STAC
BACP	–	–	–	–
Routing				
Bridging	Yes	Yes	Yes	Yes
IP Routing	Yes	Yes	Yes	Yes
IP Address Xlation	Yes	Yes	Yes	Yes
RIP	Yes	Yes	Yes	Yes
IPX Routing	Yes	Yes	Yes	Yes
IPX Spoofing	Yes	Yes	Yes	Yes
Dynamic Bandwidth Allocation	Yes	Yes	Yes	Yes
# Simult. Connections	2	2	2	2
# Profiles	20+	20+	20+	20+
Management & Security				
PAP/CHAP	Yes	Yes	Yes	Yes
Callback	Yes	Yes	Yes	Yes
CLID	Yes	Yes	Yes	Yes
SecureID	–	–	–	–
Packet filtering	Yes	Yes	Yes	Yes
Dynamic Firewall Support	limited	limited	limited	limited
SNMP Agent	Yes	Yes	Yes	Yes
Telnet Access	Yes	Yes	Yes	Yes
Proprietary Access	–	–	–	–
TFTP Download	Yes	Yes	Yes	Yes
GUI Interface	Yes	Yes	Yes	Yes
Voice				
# POTS Ports	none	none	2	2
Incoming call preemption	n/a	n/a	Yes	Yes
Outgoing call preemption	n/a	n/a	–	–
Voice Features	n/a	n/a	–	–

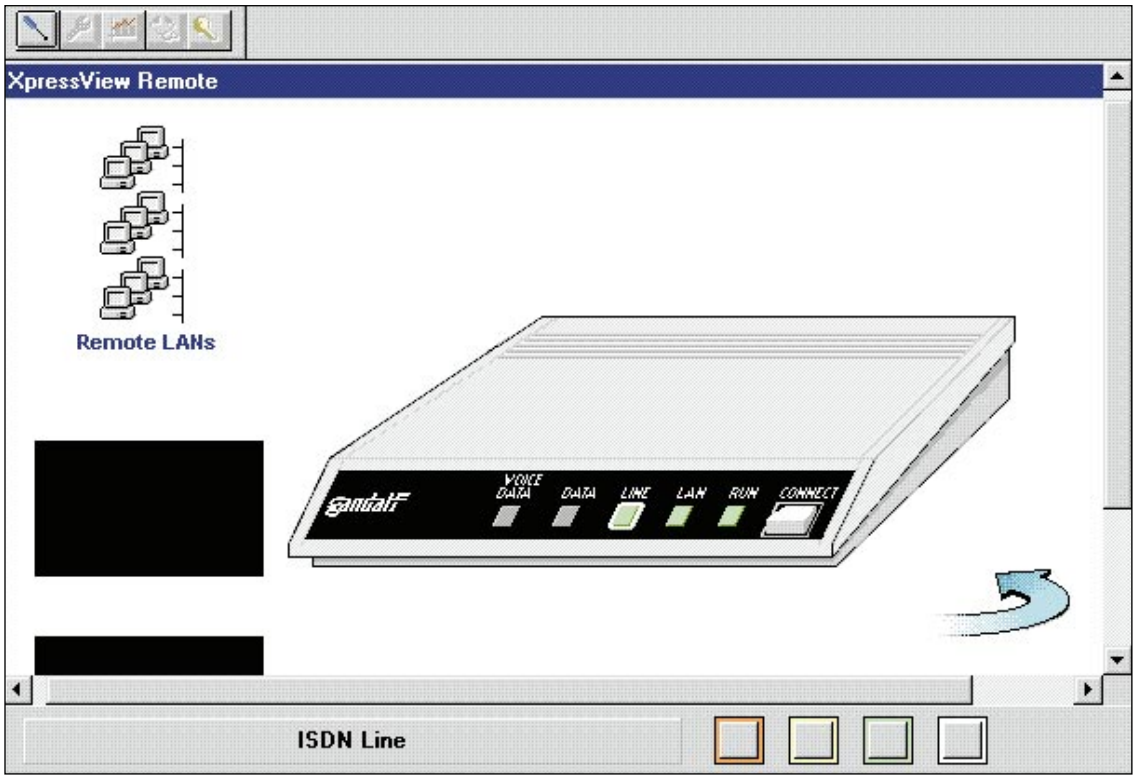
Gandalf XpressConnect

	Xpressconnect 5232i (data)	Xpressconnect 5232i (voice)	Xpressconnect 5242i (data)	Xpressconnect 5242i (voice)
List Price	$990	$1,185	$945	$1,145
Routing	Yes	Yes	Yes	Yes
Voice	–	Yes	–	Yes

The Gandalf product line consists of two products that each come in data-only and voice-data versions as shown in the table below.

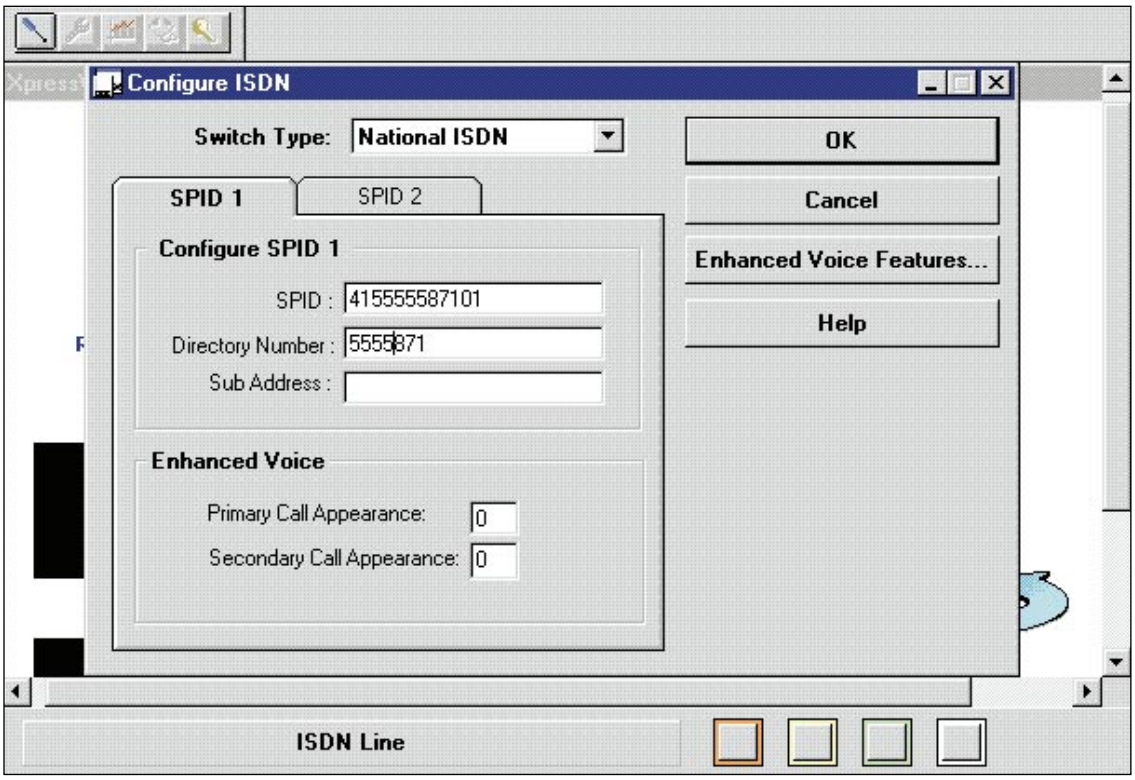
The Gandalf XpressConnect products work well when they are used with Gandalf's XpressStack and Xpressway products on the network. They support IP and IPX routing. The Gandalf XpressConnect was only one of two product lines besides the Ascend Pipeline Series that support the three criteria for ISDN client routers discussed in Chapter 1 – MP support, compression, and an graphics user interface configuration utility. However, we did find that the Gandalf XpressConnect was not stable enough for deployment in production applications connecting to Ascend MAX WAN access switches.

The Xpressconnect comes with a graphics user interface program that can be used to fully configure the product. We found that while this utility worked under Windows 95, it would not work under Windows NT Workstation Version 4.0. The screen below shows the graphics utility.



The screen shows the 5242I and the Remote sites. To get to a detailed configuration you left click on an indicator, connector, or Remote LAN and then right click and select the "Configuration" menu entry. You can turn the unit around to access the connectors by clicking on the curved arrow. The screen below shows the menu that comes up when you select the LINE (ISDN) indicator.

This interface is very graphic, but it can be difficult to find the specific item that you are searching for. It is not always obvious which icon leads to a specific parameter.



The XpressConnect does not support callback or calling line ID access security. It also does not support IP Address Translation that saves money by sharing a single-user Internet access account amongst all of the users on a LAN.

The XpressConnect also does not support the BACP protocol that can improve support for large remote access configurations. It also does not provide dynamic firewall support.

Product Test: Xpressconnect 5242i (voice)

We tested a voice and data version of the Xpressconnect 5242i. Its strengths and weaknesses relative to the Ascend Pipeline series are described in the table to the right.

Xpressconnect 5242i	Multi-user router
Software Version Tested:	2.4.3
Strengths: + Good IP and IPX routing support + Good graphics interface configuration utility	
Weaknesses: – Reduced throughput – Dropped second B-channel connections too quickly – Connections to a MAX 1800 were not stable – Second B-channels did not always recover after being preempted by a voice call. – Does not support BACP – Does not support IP Address Translation – Does not support callback or Calling Line ID access security – Does not include dynamic firewall support	

We had a lot of difficulty getting the Xpressconnect to work with our MAX 1800. The first software load that we received would not maintain a PPP connection for more than a couple of minutes. A second software load would not make a PPP connection at all. Gandalf said that they had some problems in their MP+ implementation. A third software load was stable enough to allow us to run our tests, but only with considerable tweaking.

The third software load dropped the second B-channel connections on FTP Puts. We were able

to run our tests by changing the profile on the MAX to force both B-channels up all the time. We would want this problem to be resolved before we would put the Xpressconnect into production.

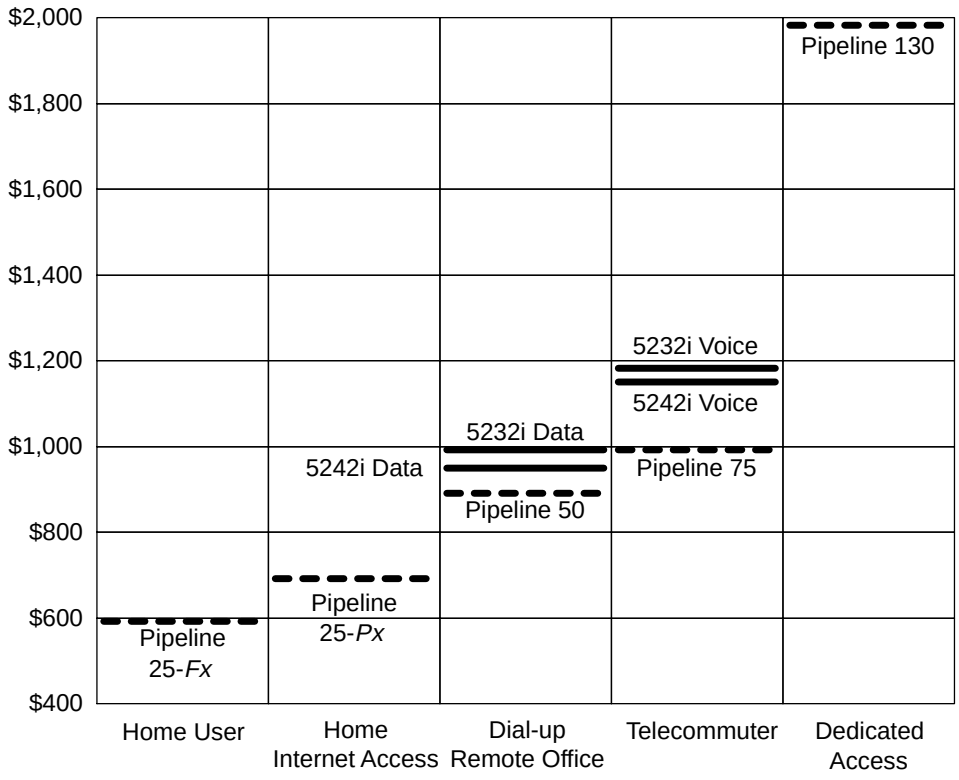
We also found that the second B-channel connection came down as soon as the traffic levels dropped off. This could increase usage charges if the first minute is charged at a higher rate than subsequent minutes.

We found that a second B-channel data call did not always recover after being preempted by an outgoing voice call. We would have to manually disconnect and reconnect the call using the button the Xpressconnect before the second B-channel call would come back up. We found no problems when preempting data calls with incoming voice calls.

We also found that the throughput of the Xpressconnect on PUTs of the compressible file were about 15% less than the Ascend Pipeline 50. This is a significant difference in performance.

Product Comparison

The table below compares the Gandalf Xpressconnect products to the Ascend Pipeline series. A 5242i configured comparably to the Pipeline 50 is about $50 higher. A comparably configured 5232i is about $100 higher than the Pipeline 50. The equivalent 5242i is about $150 higher than the Pipeline 75. The equivalent 5232i is about $200 higher than the Pipeline 75.



Product Matrix

The matrix below gives a detailed analysis of the features of the Gandalf Xpressconnect products.

Company	Gandalf	Gandalf	Gandalf	Gandalf
Product	Xpressconnect 5232i (data)	Xpressconnect 5232i (voice)	Xpressconnect 5242i Edge Router	Xpressconnect 5242i Voice Edge Router
List Price	$990	$1,185	$945	$1,145
Hardware				
FCC Certification	Class B	Class B	Class B	Class B
S/T Interface	Yes	Yes	Yes	Yes
U Interface	Yes	Yes	Yes	Yes
Other WAN Interfaces	–	–	–	–
ISDN/PPP				
Local Users	70	70	75	75
DOSBS	Yes	Yes	Yes	Yes
MP	Yes	Yes	Yes	Yes
MP+	Yes	Yes	Yes	Yes
Compression	STAC, Prop.	STAC, Prop.	STAC	STAC
BACP	–	–	–	–
Routing				
Bridging	Yes	Yes	Yes	Yes
IP Routing	Yes	Yes	Yes	Yes
IP Address Xlation	–	–	–	–
RIP	–	–	–	–
IPX Routing	–	–	Yes	Yes
IPX Spoofing	Yes	Yes	Yes	Yes
Dynamic Bandwidth Allocation	Yes	Yes	Yes	Yes
# Simult. Connections	2	2	2	2
# Profiles	5	5	10	10
Management & Security				
PAP/CHAP	Yes	Yes	Yes	Yes
Callback	–	–	–	–
CLID	–	–	Yes	Yes
SecureID	–	–	–	–
Packet filtering	Yes	Yes	Yes	Yes
Dynamic Firewall Support	–	–	–	–
SNMP Agent	Yes	Yes	Yes	Yes
Telnet Access	Yes	Yes	Yes	Yes
Proprietary Access	–	–	–	–
TFTP Download	Yes	Yes	Yes	Yes
GUI Interface	Yes	Yes	Yes	Yes
Voice				
# POTS Ports	none	2 option	none	1
Incoming call preemption	n/a	Yes	n/a	Yes
Outgoing call preemption	n/a	Yes	n/a	Yes
Voice Features	n/a	Fwd, Conf, CW	n/a	Fwd, Conf, CW

Motorola

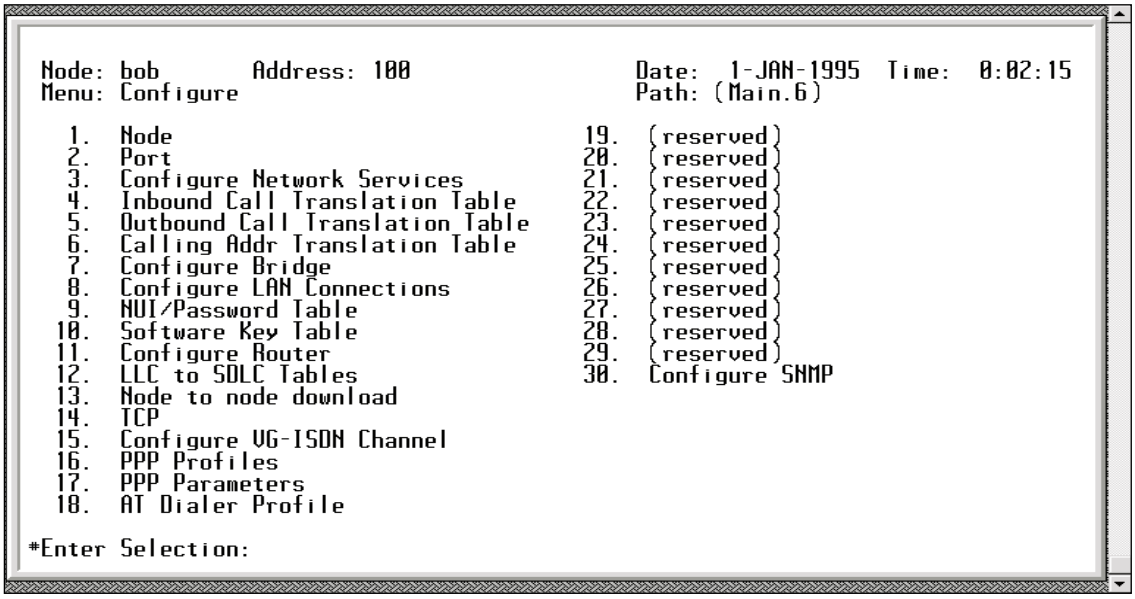
The Motorola Vanguard 310 ISDN series consists of four products as show in the table to the right. They come with bridging and IP routing support. The standard versions also support an IPX option. The Plus versions also support both IPX and AppleTalk options. The Vanguard 311 products are data-only products and the Vanguard 312 products include two POTS ports.

	Vanguard 311	Vanguard 311 Plus	Vanguard 312	Vanguard 312 Plus
List Price	$995	$1,195	$1,195	$1,395
Standard Protocols	IP, bridging	IP, bridging	IP, bridging	IP, bridging
Optional Protocols	IPX	IPX, AppleTalk	IPX	IPX, AppleTalk
Voice	–	–	Yes	Yes

The Vanguard products come with a rich set of IP and IPX routing options. They are one of the few product lines that support routing over D-channel X.25 services. They also support dial-up access to Frame Relay services over the B-channels.

The Vanguard products come with the Vanguide user interface. The Vanguide utility that we tested was not able to modify the detailed configuration of the Vanguard router. What it does is let you load sample configurations into the router. You then have to modify the sample configuration to meet your needs. At a minimum you have to change IP addresses, subnet masks, directory numbers and SPIDs. It is likely that you will have to do a lot more than that to really get the Vanguard to work in your application.

The Vanguard products are configured using a character-based menu system. Unlike most of the other similar menu-based systems, the Vanguard menu system is very difficult to learn and use. In fact the Vanguard was the most difficult product that we tested in compiling this guide. The Vanguard's problem is that it has so many parameters in so many menus it is very difficult get them all right.



The menu screen above shows that there are 19 different sub-menus available for configuring the Vanguard. The configuration used 8 of these sub-menus and nearly 150 parameters. It took us a long time to find all of the parameters that were required for the relatively simple configuration that we set up.

The Vanguard does not have any firewall support.

Product Test: Vanguard 312 Plus

We tested the Vanguard 312 Plus. The figure to the right shows the significant strengths and weaknesses of the Vanguard routers relative to the Ascend Pipeline series. We found several serious problems. The lack of standards-based compression significantly reduces throughput when communicating with the Ascend MAX 1800.

Vanguard 312 Plus	Multi-user router
Software Version Tested:	4.98.11_Omaha
Strengths: + Good IP and IPX routing capabilities + Supports routing over ISDN D-channel X.25 services + Supports dial-up access to Frame Relay networks using ISDN B-channel calling	
Weaknesses: – Complex and difficult user interface – Proprietary compression significantly reduces throughput connecting to a MAX – Does not support for MP+ or BACP – Unnumbered interface limit access to remote router – Does not support IP Address Translation – Does not support callback access security – Does not have Firewall support – Often the Vanguard would not complete the ISDN initialization – Does not support voice features – Was not able to receive phone calls on the POTS1 port – Outgoing call preemption did not work – Preempted data call did not restart after preempting voice call was completed	

The Vanguard is really intended for applications with numbered interfaces. We did find a way to set the Vanguard up with an unnumbered interface, but with significant limitations. Specifically you are not able to ping the remote router or set up a Telnet session to the remote router over the unnumbered interface. This can be a significant limitation, especially for people who are responsible for operating and maintaining the network.

We also found that the ISDN line would often not initialize. Based on what we saw on a protocol analyzer, we suspect that this is a software problem.

We also found a number of issues with the voice support through the two POTS ports. We found that calls to the POTS2 port would be handled correctly but calls to the POTS1 port would be rejected by the Vanguard.

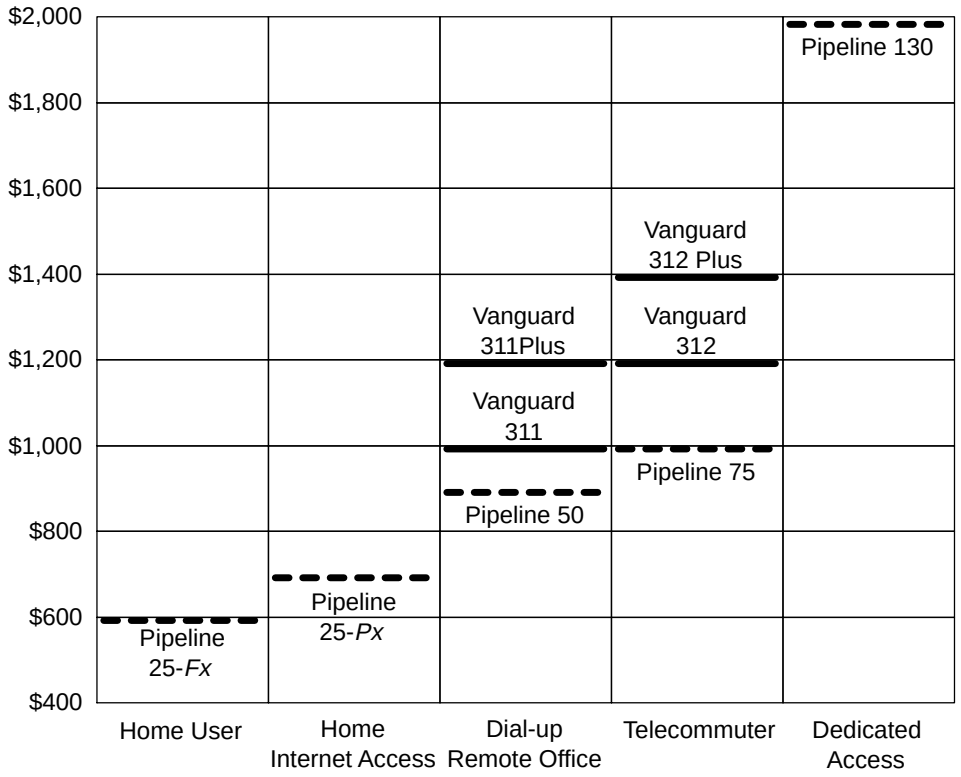
We also found significant problems when trying to preempt a data call with a call from a POTS port. With two data calls up, when we went off-hook on a phone connected to the POTS port, we would not get dial tone. We had to go back on-hook and then go off-hook to get dial tone. Once the POTS call disconnects, we also found that the preempted data call was not restored. We had to reset the unit before it would make two B-channel data transfers again.

These voice problems would need to be fixed before we would consider the Vanguard for any voice application.

We contacted Motorola's technical support three times to get help with these problems. Their technical support people were not able to identify the problem. They did not seem to understand how to configure the router to connect to the MAX 1800. They told us to make modifications to the configuration that were not appropriate. We solved our problem only after we were able to get in touch with a development engineer.

Product Comparison

The chart below compares the Vanguard products against the Ascend Pipeline series. Note that the Vanguard products are considerably more expensive than the equivalent Ascend products. The 311 is $100 more than the Pipeline 50 and the 311 Plus is $300 more than the Pipeline 50. The 312 is $200 more than the Pipeline 75 and the 312 Plus is $400 more than the Pipeline 75. Adding IPX routing to the 311 and 312 adds another $300. Adding IPX and AppleTalk routing to the 311 Plus and the 312 Plus also adds another $300.



Product Matrix

The matrix on the next page shows a detailed analysis of the Motorola Vanguard products.

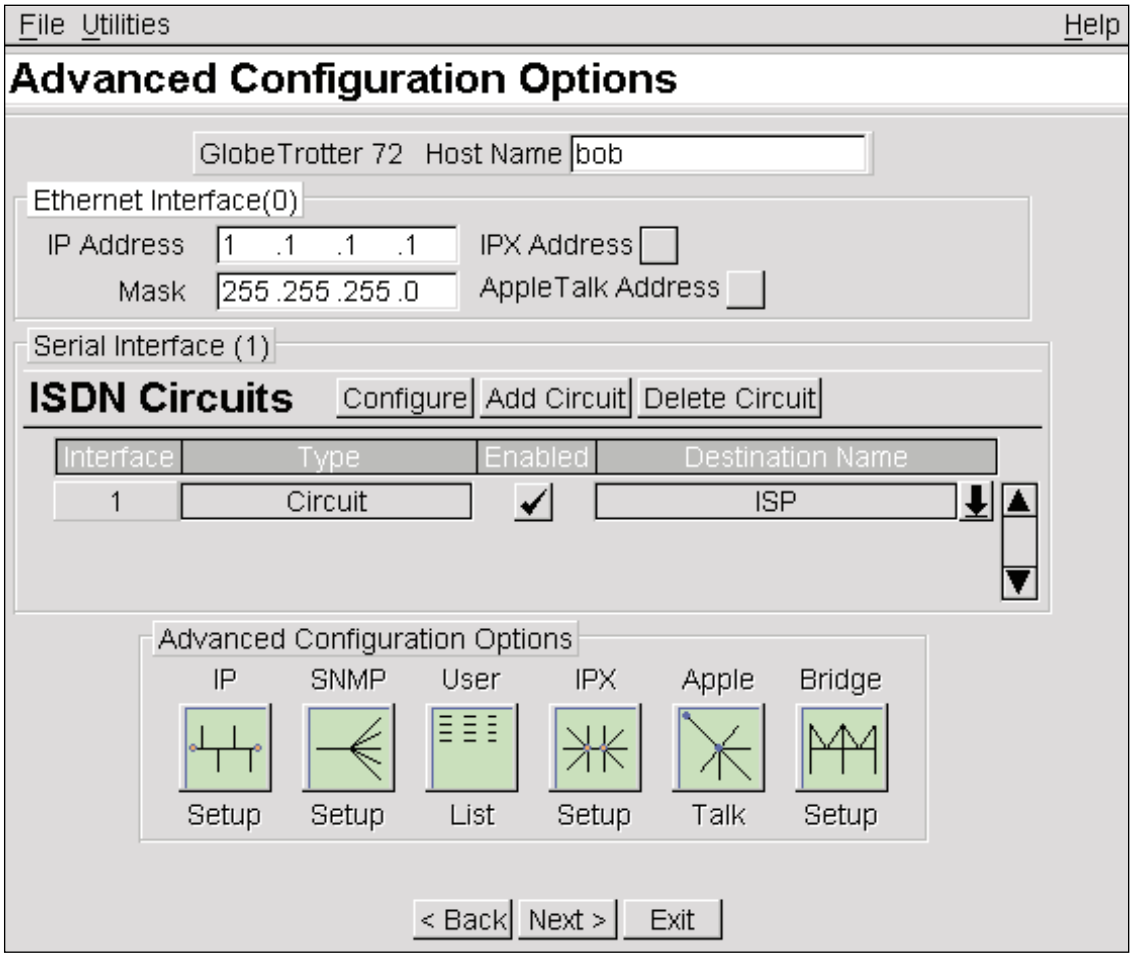
Company	Motorola	Motorola	Motorola	Motorola
Product	Vanguard 311	Vanguard 311 Plus	Vanguard 312	Vanguard 312 Plus
List Price	$995	$1,195	$1,195	$1,395
Hardware				
FCC Certification	Class B	Class B	Class B	Class B
S/T Interface	Yes	Yes	Yes	Yes
U Interface	Yes	Yes	Yes	Yes
Other WAN Interfaces	–	Frame Relay	–	Frame Relay
ISDN/PPP				
Local Users	unlimited	unlimited	unlimited	unlimited
DOSBS	Yes	Yes	Yes	Yes
MP	Yes	Yes	Yes	Yes
MP+	–	–	–	–
Compression	Proprietary	Proprietary	Proprietary	Proprietary
BACP	–	–	–	–
Routing				
Bridging	Yes	Yes	Yes	Yes
IP Routing	Yes	Yes	Yes	Yes
IP Address Xlation	–	–	–	–
RIP	Yes	Yes	Yes	Yes
IPX Routing	option	option	option	option
IPX Spoofing	Yes	Yes	Yes	Yes
Dynamic Bandwidth Allocation	Yes	Yes	Yes	Yes
# Simult. Connections	2	2	2	2
# Profiles	20+	20+	20+	20+
Management & Security				
PAP/CHAP	Yes	Yes	Yes	Yes
Callback	–	–	–	–
CLID	Yes	Yes	Yes	Yes
SecureID	Yes	Yes	Yes	Yes
Packet filtering	Yes	Yes	Yes	Yes
Dynamic Firewall Support	–	–	–	–
SNMP Agent	Yes	Yes	Yes	Yes
Telnet Access	Yes	Yes	Yes	Yes
Proprietary Access	–	–	–	–
TFTP Download	Yes	Yes	Yes	Yes
GUI Interface	Yes	Yes	Yes	Yes
Voice				
# POTS Ports	none	none	2	2
Incoming call preemption	n/a	n/a	Yes	Yes
Outgoing call preemption	n/a	n/a	Yes	Yes
Voice Features	n/a	n/a	–	–

Proteon GlobeTrotter

Proteon has two ISDN GlobeTrotter products as shown in the table to the right. The GlobeTrotter 72 is a full ISDN router that supports bridging along with good IP and IPX routing support. The GlobeTrotter 70 is a cost-effective unit that supports only IP routing.

	GlobeTrotter 70	GlobeTrotter 72
List Price	$795	$1,195
Bridging	–	Yes
IP Routing	Yes	Yes
IPX Routing	–	Yes

The Proteon is configured with a graphics user interface utility called the GlobeTrotter Setup Utility. This utility does not automatically discover the router on the Ethernet network; you load the initial configuration into the router via a serial port. It is possible to completely configure the unit with this utility. We had trouble setting up the unit with the utility and found that the quick start utility in the product itself was easier to follow. Once we understood basically how the GlobeTrotter worked, we were then able to go back and use the Setup Utility to complete the operation. The screen below shows the main window of the GlobeTrotter Setup Utility.



The ISDN parameters are set using the Configure button next to the words “ISDN Circuits”. You can set the remote profiles, as well as the IP, IPX, and AppleTalk routing and so on with the buttons on the bottom of the screen.

The GlobeTrotter 72 does not support Data Over Speech Bearer Service that is a real advantage where there is a difference between usage charges for ISDN voice and ISDN data services.

The GlobeTrotter 72 does not support MP+ or BACP which improve your ability to support two B-channel (128 Kbps) access to a network. It does not support Network Address Translation that provides access to an inexpensive, single-user Internet account from a network. It does not support either call back or SecureID access security. The GlobeTrotter 72 also do not have any firewall support.

Product Test: GlobeTrotter 72

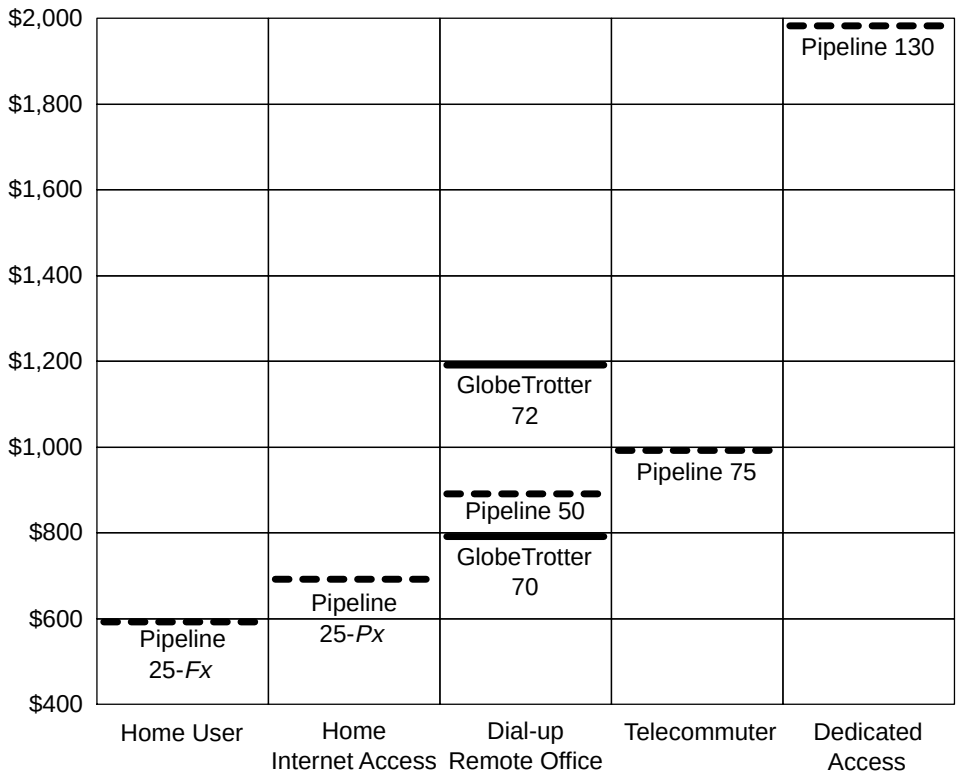
We tested the GlobeTrotter 72. The results are shown in the table to the right. We found it to be easy to use once we learned the basics. It does have good IP and IPX routing capabilities. It supports communication profiles for a large number of remote sites so it is a good router for setting up a network with a large number of remote sites to communicate with.

The GlobeTrotter does not support compression that is compatible with Ascend MAX 1800 that puts it at a significant performance handicap.

Proteon GlobeTrotter 72	Multi-user router
Software Version Tested:	1.30
Strengths: + Good IP and IPX routing capabilities + Graphics utility useful once you learn the basics + It supports connections to a large number of remote locations	
Weaknesses: – Incompatible compression significantly reduces throughput connecting to a MAX – Does not support Data Over Speech Bearer Service – Does not support MP+ or BACP – Does not support IP address translation – Does not support call back or SecureID access security – Does not have firewall support	

Product Comparison

The chart below compares the Proteon GlobeTrotter products with the Ascend Pipeline product line. The GlobeTrotter 70 is $100 less than the Pipeline 50. The GlobeTrotter 72 costs $300 more than the Pipeline 50.



Product Matrix

The matrix on the next page shows a detailed analysis of the price and features of the Proteon GlobeTrotter products.

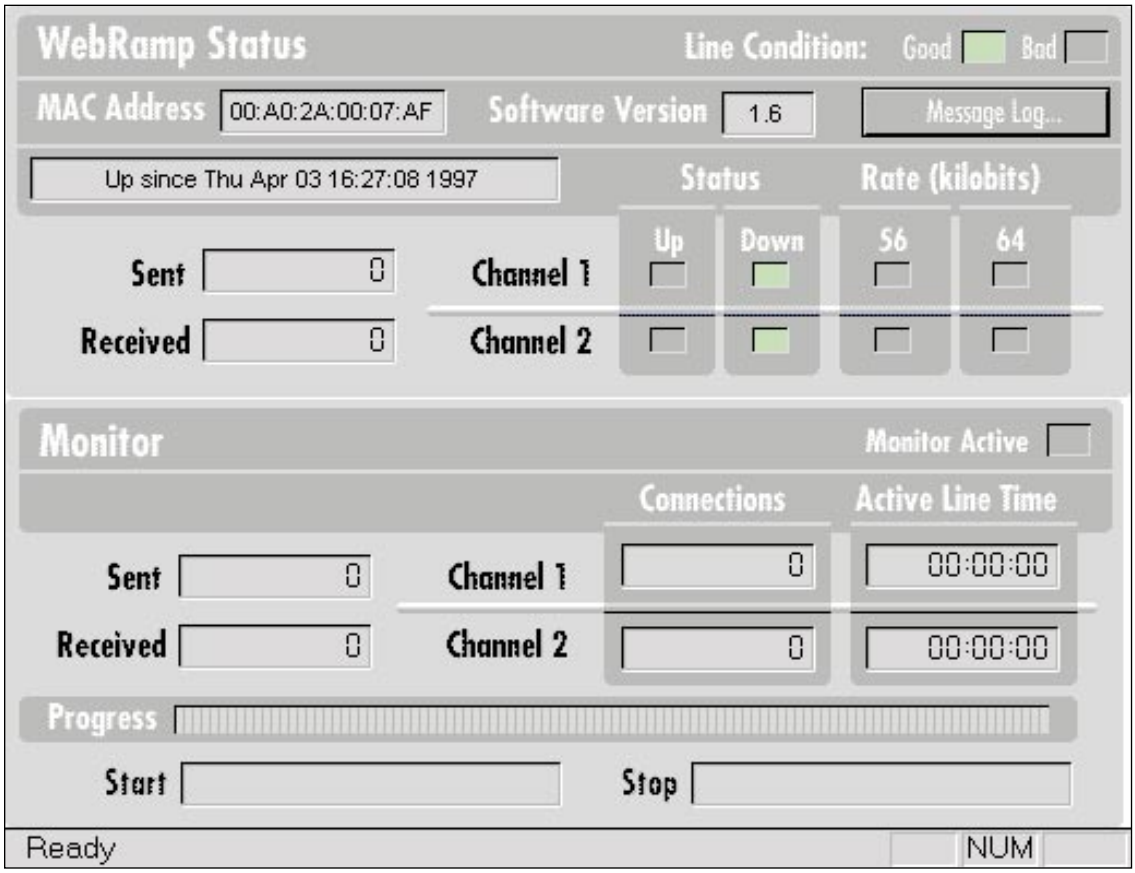
Company	Proteon	Proteon
Product	Globetrotter 70	Globetrotter 72
List Price	$795	$1,195
Hardware		
FCC Certification	Class B	Class B
S/T Interface	Yes	Yes
U Interface	Yes	Yes
Other WAN Interfaces	Frame Relay	Frame Relay
ISDN/PPP		
Local Users	unlimited	unlimited
DOSBS	–	–
MP	Yes	Yes
MP+	–	–
Compression	STAC	STAC
BACP	–	–
Routing		
Bridging	–	Yes
IP Routing	Yes	Yes
IP Address Xlation	–	–
RIP	Yes	Yes
IPX Routing	–	Yes
IPX Spoofing	–	Yes
Dynamic Bandwidth Allocation	Yes	Yes
# Simult. Connections	2	2
# Profiles	20+	20+
Management & Security		
PAP/CHAP	Yes	Yes
Callback	Yes	Yes
CLID	Yes	Yes
SecureID	–	–
Packet filtering	Yes	Yes
Dynamic Firewall Support	Yes	Yes
SNMP Agent	Yes	Yes
Telnet Access	Yes	Yes
Proprietary Access	–	–
TFTP Download	–	–
GUI Interface	Yes	Yes
Voice		
# POTS Ports	none	none
Incoming call preemption	n/a	n/a
Outgoing call preemption	n/a	n/a
Voice Features	n/a	n/a

Ramp Networks Webramp

Ramp Networks (formerly known as Trancell Systems) has two ISDN routing products as shown in the table to the right. The Webramp Entre includes two POTS ports while the Webramp IP Router includes an 8-port Ethernet hub. Ramp Networks has targeted their products to support Internet access. They are easy to set up and are cost-effective in this application.

	Webramp Entre	Webramp IP Router
List Price	$849	$899
IP Routing	Yes	Yes
8 Port Hub	–	Yes
Voice	Yes	–

The Trancell has an easy-to-use graphics user interface utility called the WebRamp Manager. This utility discovers the unit over the Ethernet. It also has a wizard that explains how to set the unit up and give it an IP address. The screen below shows the status window for the utility.



The WebRamp products support access to only two sites, so they are not appropriate for an interoffice network where it may be necessary to access multiple sites. In fact two sites are just enough to connect to the Internet and to make a connection with a network manager.

The WebRamp does not support Data Over Speech Bearer Service that is a real advantage where there is a difference between usage charges for ISDN voice and ISDN data services.

The WebRamp does not support bridging or IPX routing or spoofing, so it can only be used to access IP networks. It does not support IP Address Translation so it does not allow an inexpensive, single-user Internet account to be shared on a network.

The WebRamp does not support MP+ or BACP which improve your ability to support two B-channel (128 Kbps) access to a network. It supports only PAP or CHAP authentication. It does not support callback. Calling Line ID or SecureID access security required by users looking for an extra measure of protection. The WebRamp also do not have any firewall support. The WebRamp is one of the few routers that does not support SNMP, so it cannot be remotely monitored.

Product Test: Webramp IP Router

We tested the Webramp IP Router. The table to the right shows the significant strengths and weaknesses of the Webramp compared to the Ascend Pipeline series. The Webramp is easy to set up and includes everything you need to connect to the Internet.

The Webramp does not support compression that significantly reduces throughput. It also drops the second B-channel connection very quickly, which can raise usage costs, especially when the first minute costs significantly higher than subsequent minutes.

Webramp IP Router	Multi-user router
Software Version Tested:	1.6

Strengths:

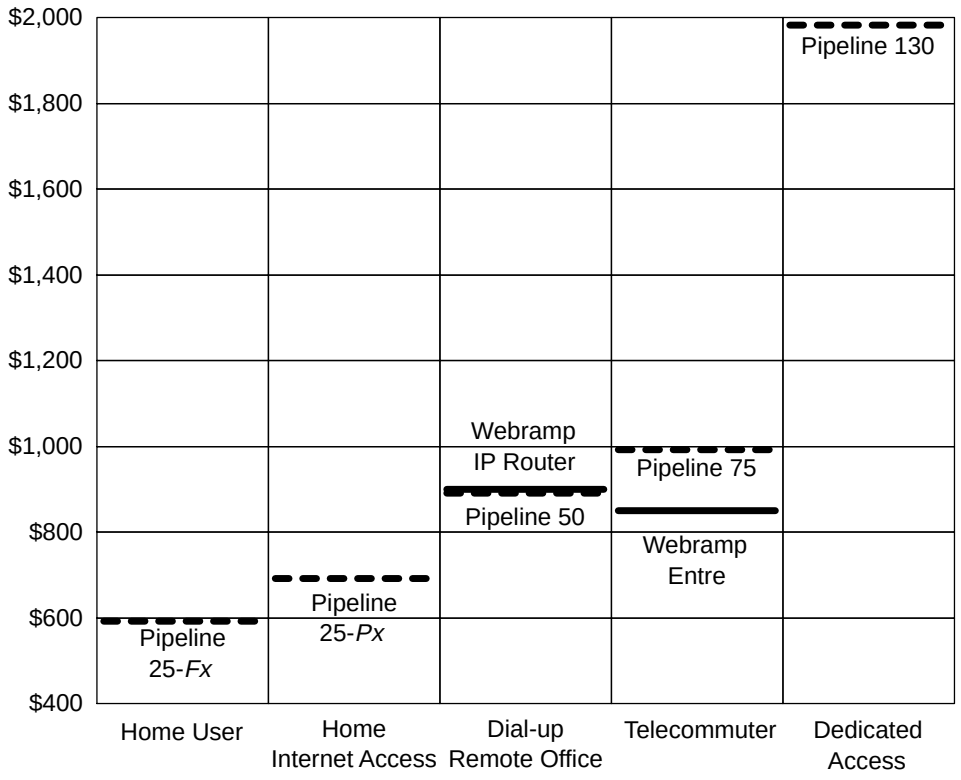
+ Cost-effective for Internet access
+ Includes a four port hub

Weaknesses:

– Does not support compression which significantly reduces throughput connecting to a MAX
– Drops the second B-channel very quickly which may increase usage costs
– Does not support Data Over Speech Bearer Service
– Does not support MP+ or BACP
– Does not support bridging
– Does not support IP Address Translation
– Does not support RIP
– Does not support IPX Routing or Spoofing
– Does not support callback, Calling Line ID, or SecureID access security
– Does not have Firewall support
– Does not support SNMP

Product Comparison

The chart below compares the Webramp products against the Ascend Pipeline series. The Web Ramp IP Router is the same price as the Pipeline 50 but it does include a four port hub. The Webramp Entre is about $150 less expensive than the Pipeline 75.



Product Matrix

The matrix on the next page shows a detailed analysis of the price and features of the Ramp Networks Webramp products.

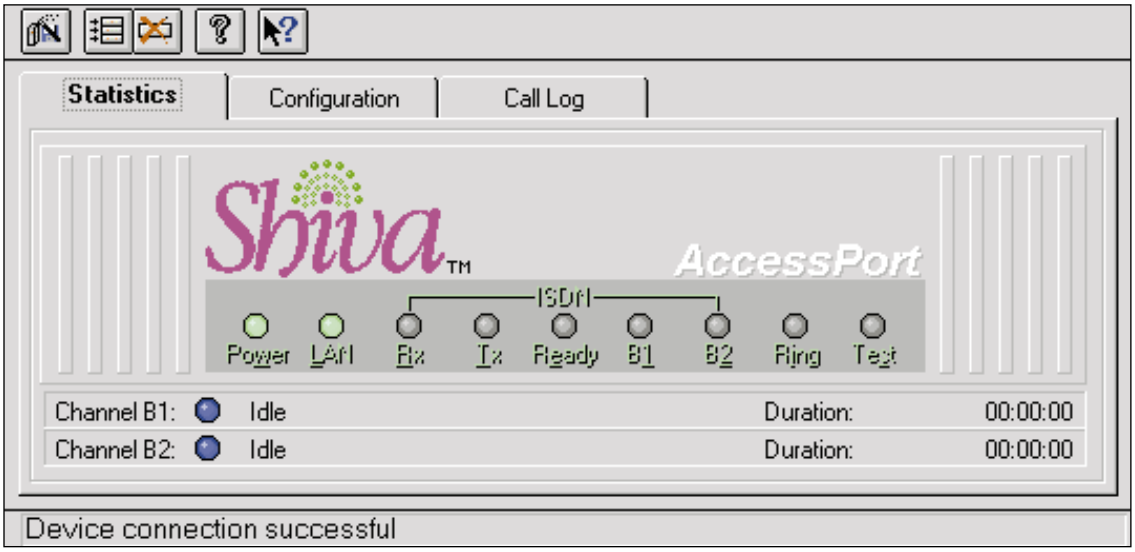
Company	Ramp Networks	Ramp Networks
Product	Webramp Entre	Webramp IP Router
List Price	$849	$899
Hardware		
FCC Certification	Class B	Class B
S/T Interface	–	–
U Interface	Yes	Yes
Other WAN Interfaces	–	–
ISDN/PPP		
Local Users	unlimited	unlimited
DOSBS	–	–
MP	Yes	Yes
MP+	–	–
Compression	–	–
BACP	–	–
Routing		
Bridging	–	–
IP Routing	Yes	Yes
IP Address Xlation	–	–
RIP	–	–
IPX Routing	–	–
IPX Spoofing	–	–
Dynamic Bandwidth Allocation	Yes	Yes
# Simult. Connections	2	2
# Profiles	2	2
Management & Security		
PAP/CHAP	Yes	Yes
Callback	–	–
CLID	–	–
SecureID	–	–
Packet filtering	Yes	Yes
Dynamic Firewall Support	–	–
SNMP Agent	–	–
Telnet Access	Yes	Yes
Proprietary Access	–	–
GUI Interface	Yes	Yes
Voice		
# POTS Ports	2	none
Incoming call preemption	Yes	n/a
Outgoing call preemption	Yes	n/a
Voice Features	HCDT	n/a

Shiva AccessPort

	AccessPort/D	AccessPort
List Price	$795	$995
Routing	Yes	Yes
Voice	–	Yes

The Shiva AccessPort products are described in the table to the right. One of these models is a data-only router and the other supports voice and data. The AccessPort products are very competitive with the Ascend Pipeline products. They have good support for IP and IPX routing. They easy to use and support a full set of security options.

Shiva as a graphics based user interface called the Shiva Monitor that simplifies the setup and operation of the AccessPort products. The Shiva Monitor was the most complete and easiest to use of all of those tested. It comes with an Install Wizard that leads through the initial setup of the unit. The Shiva Monitor can then be used to fine tune the configuration and monitor its operation. The main screen of the Shiva Monitor is shown below.



The screen shown mirrors the status lights of the unit itself and gives some B-channel connection information. The Configuration tab gives access to all of the device parameters. The Call Log gives historical information about the operation of the router.

Product Test: Access Port

We tested the Shiva AccessPort. The figure to the right shows its strengths and weaknesses compared to the Ascend Pipeline products. The Shiva was easy to set up and operate.

Shiva AccessPort	Multi-user router
Software Version Tested:	1.3.2

Strengths:

+ Excellent graphics user interface utility
+ Good IP and IPX routing support
+ Full support of access security options

Weaknesses:

– Incompatible compression significantly reduces throughput connecting to a MAX
– Will not add a second B-channel based on traffic from the MAX 1800 – will only add second B-channel based on traffic toward the MAX 1800.
– Does not support 5ESS Custom multipoint BRI configuration
– Does not support Data Over Speech Bearer Service
– Does not support MP+
– Does not support Calling Line ID or SecureID access security
– Does not have firewall support
– Does not support voice features
– Loopback test did not work because of our ISDN BRI line

The compression on the AccessPort is not compatible with the Ascend MAX 1800. This can significantly reduce throughput with compressible files.

The AccessPort will not add a second B-channel based on traffic from the MAX 1800. It will only add the second B-channel based on traffic that it sends to the MAX 1800. This will also reduce effective throughput in many cases.

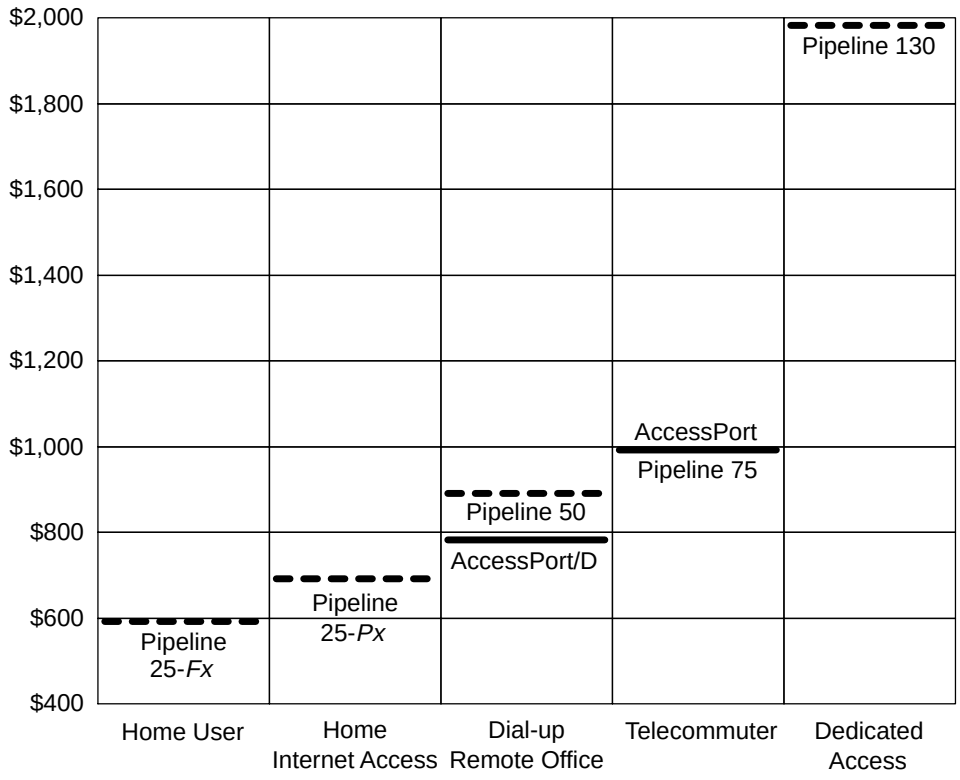
The AccessPort will not work on a Lucent 5ESS Custom multipoint line, only on a 5ESS Custom point-to-point line. We also found that their loop back test did not work on our ISDN BRI lines in the Install Wizard. We were able to get the loop back test to work manually after we entered the one plus ten digit phone number.

The AccessPort does not support Data Over Speech Bearer Service that is a real advantage where there is a difference between usage charges for ISDN voice and ISDN data services.

The AccessPort does not support MP+ or BACP which improve your ability to support two B-channel (128 Kbps) access to a network. It does not support either Calling Line ID or SecureID access security. The AccessPort also do not have any firewall support.

Product Comparison

The chart below compares the Shiva AccessPort products to the Ascend Pipeline series. The data-only AccessPort is $100 less than the Pipeline 50. The voice/data AccessPort has the same price as the Pipeline 75.



Product Matrix

The matrix on the next page shows a detailed analysis of the price and features of the Shiva AccessPort products.

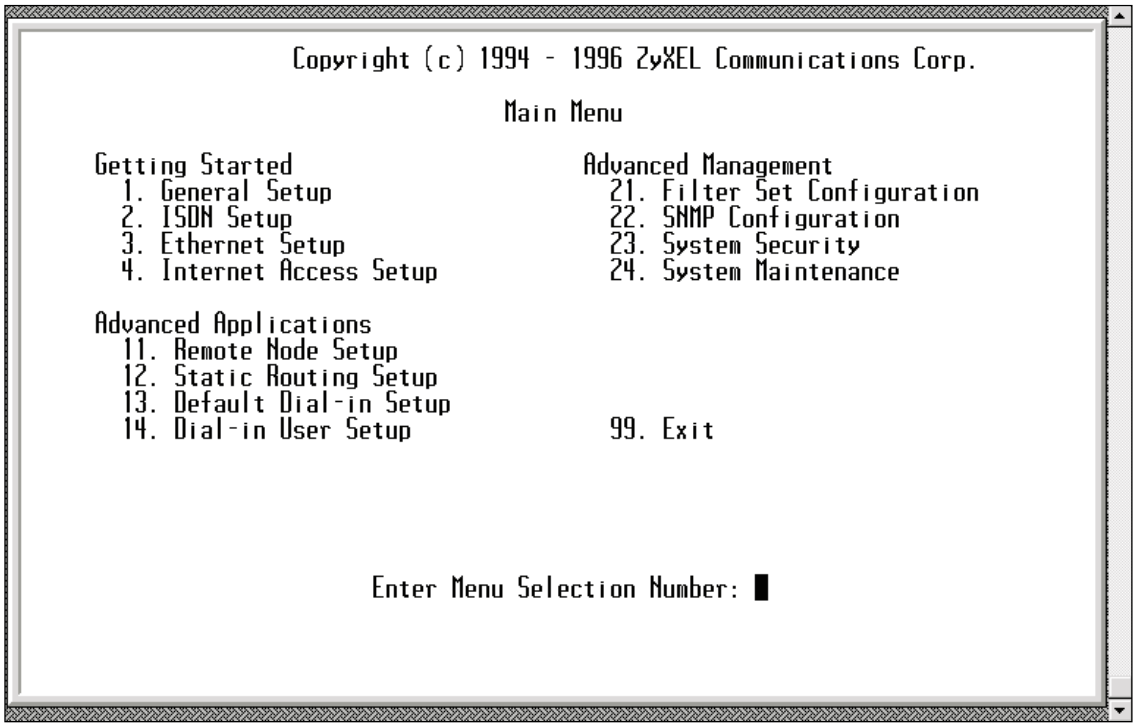
Company	Shiva	Shiva
Product	AccessPort/D	AccessPort
List Price	$795	$995
Hardware		
FCC Certification	Class B	Class B
S/T Interface	Yes	Yes
U Interface	Yes	Yes
Other WAN Interfaces	–	–
ISDN/PPP		
Local Users	unlimited	unlimited
DOSBS	–	–
MP	Yes	Yes
MP+	–	–
Compression	STAC	STAC
BACP	Yes	Yes
Routing		
Bridging	Yes	Yes
IP Routing	Yes	Yes
IP Address Xlation	Yes	Yes
RIP	Yes	Yes
IPX Routing	Yes	Yes
IPX Spoofing	Yes	Yes
Dynamic Bandwidth Allocation	Yes	Yes
# Simult. Connections	2	2
# Profiles	32	32
Management & Security		
PAP/CHAP	Yes	Yes
Callback	Yes	Yes
CLID	Yes	Yes
SecureID	Yes	Yes
Packet filtering	Yes	Yes
Dynamic Firewall Support	–	–
SNMP Agent	Yes	Yes
Telnet Access	Yes	Yes
Proprietary Access	–	–
TFTP Download	–	–
GUI Interface	Yes	Yes
Voice		
# POTS Ports	none	2
Incoming call preemption	n/a	Yes
Outgoing call preemption	n/a	Yes
Voice Features	n/a	–

ZyXEL

The ZyXEL has two ISDN router products as described in the table to the right. Both product support voice. The Prestige 128 has two POTS ports. The Prestige 2864i replaces one of the POTS ports with an internal digital modem that supports V.34 modem communication over the ISDN line. The Prestige products include good IP and IPX routing capabilities.

	Prestige 128	Prestige 2864i
List Price	$799	$1,099
IP Routing	Yes	Yes
Voice Ports	2	1
V.34 Modem	–	Yes

The Prestige products are easy to use with a character-based internal menu system. An example of its menu screen is shown below.



You enter the number of the menu item to activate it. One of the nice features of the Prestige units is that they will do a loop-back call back to themselves to verify the operation of the ISDN line when you finish the ISDN configuration.

The 2854i does not support Data Over Speech Bearer Service which is a real advantage where there is a difference between usage charges for ISDN voice and ISDN data services.

The 2854i does not support MP+ which improve your ability to support two B-channel (128 Kbps) access to a network supported by Ascend MAX Access Switches. It does not support either Calling Line ID or SecureID access security. The 2854i also do not have any firewall support.

Product Test: Prestige 2864i

We tested the ZyXEL 2864i. The table to the right compares the strengths and weaknesses of the Prestige 2864i compared to the Ascend Pipeline series.

The Prestige 2864i were easy to set up and worked well.

The biggest issue with them is that they support only the Microsoft form of compression. This means that you have to set up a special profile for them on a MX that selects Microsoft compression.

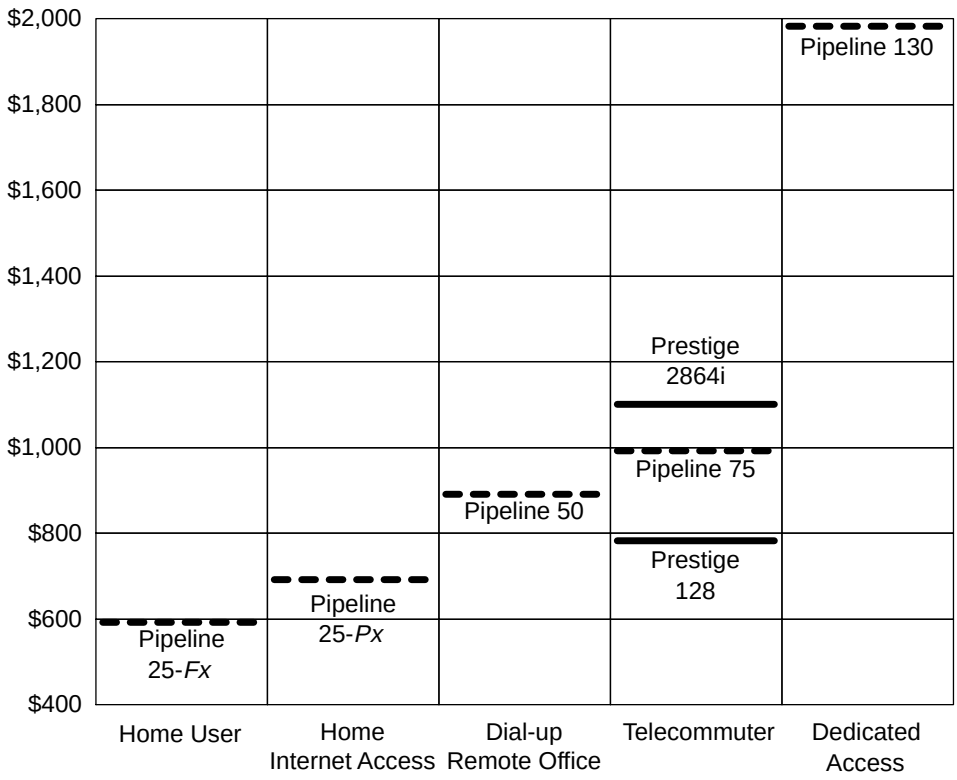
Prestige 2864i	Multi-user router
Software Version Tested:	1.6

Strengths:
- \+ Includes digital V.34 modem support
- \+ Easy to use
- \+ Good IP and IPX routing support

Weaknesses:
- – Supports on Microsoft style compression which requires a special profile to be created on the Ascend MAX 1800
- – Does not support MP+
- – Does not support SecureID access control
- – Does not have Firewall support
- – Does not support voice features

Product Comparison

The table below compares the Prestige products against the Ascend Pipeline series. The Prestige 128 is $200 less than the Pipeline 75. The Prestige 2864I costs $100 more than a Pipeline 75 but it includes a digital V.34 modem.



Product Matrix

The matrix on the next page gives a detailed analysis of the price and features of the ZyXEL Prestige products.

Company	ZyXel	ZyXel
Product	Prestige 128	Prestige 2864i
List Price	$799	$1,099
Hardware		
FCC Certification	Class B	Class B
S/T Interface	Yes	Yes
U Interface	Yes	Yes
Other WAN Interfaces	–	–
ISDN/PPP		
Local Users	unlimited	unlimited
DOSBS	Yes	Yes
MP	Yes	Yes
MP+	–	–
Compression	STAC	STAC
BACP	Yes	Yes
Routing		
Bridging	Yes	Yes
IP Routing	Yes	Yes
IP Address Xlation	Yes	Yes
RIP	Yes	Yes
IPX Routing	Yes	Yes
IPX Spoofing	Yes	Yes
Dynamic Bandwidth Allocation	Yes	Yes
# Simult. Connections	2	2
# Profiles	4	4
Management & Security		
PAP/CHAP	Yes	Yes
Callback	Yes	Yes
CLID	Yes	Yes
SecureID	–	–
Packet filtering	Yes	Yes
Dynamic Firewall Support	–	–
SNMP Agent	Yes	Yes
Telnet Access	Yes	Yes
Proprietary Access	–	–
TFTP Download	–	–
GUI Interface	–	–
Voice		
# POTS Ports	2	1
Incoming call preemption	Yes	Yes
Outgoing call preemption	Yes	Yes
Voice Features	–	–

Appendix A: Description of Matrix Entries

This appendix includes a description of each of the entries in the detailed matrices given for each product.

Company	Name of company offering the product
Product	Name of each product profiled
List Price	Manufacturers list price
Hardware	
FCC Certification	Emissions certification. Class A is for business locations. Class B is for residential locations.
S/T Interface	There is a model of the product that supports the ISDN BRI S/T-interface.
U Interface	There is a model of the product that supports the ISDN BRI U-interface.
Other WAN Interfaces	Physical interfaces for connections to network services other than ISDN. Examples include RS232, V.35, or X.21 interfaces.
ISDN/PPP	
Local Users	The number of workstations that can be supported on the Ethernet LAN. Most products support LANs of arbitrary size. Some products have reduced prices for models that support one to a hand-full of hosts on the LAN.
DOSBS	Data Over Speech Bearer Service. Products that support this feature can transmit 56 Kbps over a B-channel that is connected to the voice network. While there is no guarantee of end-to-end data connectivity over the voice network, it usually works. This feature lets you take advantage of lower tariffs where voice usage rates are lower than data usage rates.
MP	Supports Multilink Protocol Plus (RFC 1717) which combines two B-channels for a 128 Kbps connection.
MP+	Supports Multilink Protocol Plus (RFC 1934) which combines two B-channels for a 128 Kbps connection. It includes the ability to manage the B-channel connections in ways that scale well for networks that need two or more units on their network to support remote access.
Compression	Supports some form of compression. A “Yes” in this column does not guarantee multi-vendor interoperability. Each Product Test describes whether the compression on each product interoperates with an Ascend MAX 1800.
BACP	Supports the Bandwidth Allocation Control Protocol and the Bandwidth Allocation Protocol (RFC 2125) that include the ability to manage the B-channel connections in ways that scale well for networks that need two or more units on their network to support remote access.
Routing	
Bridging	Product supports Layer 2 bridging using the PPP Bridging Control Protocol (RFC 1638).
IP Routing	Product supports IP routing using the PPP IP Control Protocol (RFC 1332).

Routing (cont'd)	
IP Address Translation	Product supports IP Address Translation that provides simultaneous access from one or more hosts on a LAN to a single-user Internet account.
RIP	Products supports dynamic routing using the RIP protocol (RFC 1058 and 1388).
IPX Routing	Product supports Novell Netware's IPX routing (RFC 1634).
IPX Spoofing	Product supports techniques that minimize overhead packet traffic when connecting Novell Netware networks over dial-up ISDN connections. Spoofing will minimize connection time for sending unnecessary overhead packets.
Dynamic Bandwidth Allocation	Product makes and breaks connections based on the existence of packet traffic on the network.
# Simultaneous Connections	The number of simultaneous, independent connections. It may be one or two.
# Profiles	The number of remote locations that the router can store and automatically connect to based on network addresses in packets.
Management & Security	
PAP/CHAP	Basic PPP authentication protocols (RFC 1334)
Callback	An authentication technique where the ISDN router disconnects after authenticating an incoming call and then calls back to a known phone number for that user. This technique prevents somebody who has learned a User ID and Password from accessing a network.
CLID	An authentication technique that uses the Calling Line ID provided by the network to validate that the user is calling from a known location. It also prevents somebody who has learned a User ID and Password from accessing a network.
SecureID	An authentication method that uses a credit card that displays a constantly changing key value. This method prevents somebody who has learned a User ID and a Password and also has access to a "legal" location from accessing a network.
Packet filtering	A packet for suppressing packet traffic across the LAN based on the contents of the packet. Packet filtering lets you control access to specific network resources.
Dynamic Firewall Support	Support for a firewall software package that supports dynamic filtering.
SNMP Agent	Support for remote network management of the router using the SNMP protocols (RFC 1213).
Telnet Access	The product can be monitored and configured across the LAN or WAN using the Telnet protocol.
Proprietary Access	The product can be monitored and configured across the LAN or WAN using a manufacturer specific protocol.
TFTP Download	The product's software can be updated across the LAN or WAN using the TFTP protocol.
GUI Interface	The product has a graphics user interface utility that runs on a PC or other workstation that can be used to monitor or configure the operation of the router.

Voice	
# POTS Ports	The number of RJ-11 POTS ports on the router for handling voice, modem, or fax communication over the ISDN lines.
Incoming call preemption	Provides the ability to receive an incoming voice, modem, or fax call even if both B-channels are in use for data calls.
Outgoing call preemption	Provides the ability to receive an outgoing voice, modem, or fax call even if both B-channels are in use for data calls.
Voice Features	Router supports ISDN voice supplementary services like: ■ **Call Waiting:** notification of an incoming call while already on another phone call. ■ **Hold:** ability to maintain a connection while making or answering another call. ■ **Conference:** ability to bridge two or more calls together so all parties can converse in a conference call. ■ **Drop:** ability to disconnect the last party added to a conference call. ■ **Transfer:** ability to transfer a call to another party. ■ **Forward:** ability to cause an incoming call to be redirected to another number.

Larribeau Associates has extensive experience with ISDN remote access. Bob Larribeau has been working with ISDN for ten years and is a director of the California ISDN Users' Group.