Ascend

Competitive Evaluation Report

Ascend MAX 400X Vs. US Robotics Total Control Enterprise Network Hub

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I. Executive Summary

The purpose of this report is to provide competitive attack strategies based on a detailed analysis of US Robotics (USR) and its Total Control Enterprise Network Hub (USR Total Control).

According to USR, the Total Control line accounted for approximately $400 million in revenues in FY'96; their gross margin on this product is estimated at 65%. After the acquisition by 3Com, it is clear that the USR Total Control will become the combined company's remote access platform, although integration with the 3Com AccessBuilder line and the 3Com TranscendWare network management system is expected.

In Q4'96, USR Total Control had a 28% share of worldwide access concentrator analog ports, and only a 5% share of ISDN PRI ports. (Dell'Oro Group, 2/18/97)

Company Weaknesses

- Prior to their acquisition by 3Com, USR was struggling with a flat modem market, and restricted cash flow; the company had clearly invested its future in its proprietary x2 56 Kbps technology. Given their market share of 25% in the analog client modem market, this investment was a serious gamble. After heavy marketing expenses, x2 was not delivered on schedule. USR has met serious resistance from the almost concurrent release of the Rockwell/Lucent chip, and K56flex-compatible products
- The combined companies' stance on standards, in particular 56 Kbps, is unclear; USR has not agreed to join the Open 56K Forum. Today, the combined companies do not have the market presence to make the proprietary x2 56K technology work
- Challenges of the recent merger are enormous in terms of integrating the operations and handling overlaps in the LAN/ATM switching and remote access product lines
- The combined companies do not have the presence, or the product, to compete in the high-end carrier class access and routing arena. (50% of their combined business is in adapters/modems)
- Neither 3Com nor USR is known for innovation, market leadership or new market creation

Perceived Company Strengths

- USR has a reputation for aggressive marketing and a strong channel strategy
- USR has a strong brand name in analog modems; they have managed to achieve mind share with x2
- USR may be able to capitalize on 3Com's position in the enterprise segment
- The combined company will be a leader in the NIC market and a strong player at the network edge

Product Analysis

Today, the USR Total Control does not have the density, scalability, flexibility or price to compete with the MAX™ product family.

USR has promised to release a six shelf, high-density Total Control in late summer 1997; this product has been promised to support 336 analog modems per shelf, or 2016 per six shelf rack. This new higher density concentrator will be based on a multimodem chip. Each digital modem card will support 24 analog calls using two modems per analog line, and one PRI/T1/E1 interface. Given USR's problems delivering the x2 product on time, this nonspecific summer release date may not be met.

Contrary to USR's sponsored testing, and subsequent released reports, the Total Control Hub does not meet performance standards, nor can it scale with the MAX 400X. Under performance testing conducted by the Tolly Group, the USR Total Control's performance in terms of throughput was demonstrated to peak at 16 sessions, and diminish with additional calls.

USR has a serious problem with the routing code that it licenses from Livingston for the Total Control: their agreement with Livingston will end in October 1997. After a suit between the two companies over retention of rights to the software, an out of court settlement requires US Robotics to return the code in October. Recently,

USR has announced that it will begin shipping internally developed routing code. At the same time, 3Com has stated that the companies' combined products will integrate using 3Com's TranscendWare management platform. These developments will engender significant uncertainty and require significant administrative/technical support and sales attention in order to maintain the Total Control installed base in Q3/Q4'97. Furthermore, confusion should negatively impact sales of the higher density product as well.

While USR has deployed x2 in its Courier/Sportster modem lines, and the Total Control Hub, it is not achieving promised speeds in the field, and it has not achieved a significant presence in the ISP segment. In addition, there are rumors that the client modem software is still problematic, and not fully deployed at this time. Apparently USR's Megahertz modems have retained a Rockwell chipset, making them incompatible with the USR Total Control.

USR has announced RADSL-capable product for Q2'97, and plans for a hybrid x2/xDSL modem in development with Texas Instruments is planned for release in 1998. In addition, in March 1997, USR introduced an end-to-end cable access system based on the Total Control network platform through its Cable Access Business Unit.

Today, the Total Control is priced at up to a 70% premium over the MAX product (based on U.S. list pricing).

USR is expected to announce a high density upgrade for the Total Control; the upgrade will feature a new module that supports 24 digital ports and an T1/E1 port, 100Base-T Ethernet, and new, internally developed software code. With the upgrade, the Total Control's density will increase to 336 ports per chassis, and 2016 per Telco rack. The upgraded system is expected to sell for $450 to $500 per port.

Please refer to Appendix C: MAX TNT VS. USR Total Control Hub (High Density Version): Key Feature Comparison and Selling Points.

A summary comparison of the key features of the MAX 400X and USR Total Control follows.

Summary Comparison of Ascend MAX 400X's Advantages Over USR Total Control

Key Customer Requirements	Ascend MAX 400X	USR Total Control
Cost per Port, Cost of Ownership	Lower per port prices for analog ($550-$690) and ISDN B-channel ($189)	High price for analog ports ($920) and ISDN B-channel ($421) at this time
Scalability/Flexibility	• Up to 96 concurrent ISDN sessions/box (120 for E1) • up to 96 digital modems/box • 4 T1/E1/ PRIs per box	• 230 concurrent ISDN sessions • 48 analog modems (336 planned)/ box • 2 T1/E1 **or** ten PRIs per box
WAN Connectivity	Full range of WAN connectivity options	No ISDN BRI and Switched 384/1536 support; No Multirate, Nx64 support
Bandwidth Management and Control	Comprehensive set of features including Multilink PPP (MP), Multiprotocol Plus™ (MP+), Multichassis MP and MP+	Limited bandwidth management and control . No dynamic B-channel aggregation within the chassis or between multiple chassis.
Investment Protection	• Market proven, in-house code development • 3 year track record • Market proven ISDN expertise • Member of Open 56K Forum-supports K56flex • IDSL support	• Routing functionality relies on old Livingston code - may not be upgradeable in the future • Relatively new product (introduced in early 1996) • Limited ISDN track record • Proprietary 56K technology • RADSL-CAP support promised
Multimedia Integration	• Supports inverse multiplexing. BONDING, video conferencing, desktop video conferencing • Supports IP Multicast	No support for multimedia or IP Multicast
Interoperability	IP, IPX, AppleTalk, OSPF, RIP2, IP Multicast	IP, IPX
Network Management	Support across product families and multivendor equipment- device grouping	High cost single device management
Security and VPN capability	Comprehensive security options including : • RADIUS extensions (120+), • Integrated dynamic firewall option • VPN support for over one year	• Limited security • Limited RADIUS support • No integrated firewall software • VPN capability just announced
Carrier Network Support	NEBS compliance and key signaling conversion functionality	No signaling conversion (PRI- to-T1/E1 and D4-to-ESF conversion)

II. Description of the USR Total Control

Product Description

An overview of the USR Total Control:

- Modular 16-slot system for integrating analog, ISDN and Frame Relay over T1/E1/PRI
- Currently support for 48 modems, two T1/E1s, or 10 PRIs
- With new multichip modem cards promised for Q2/Q3'97, will support 336 analog and/or ISDN calls; a potential 2016 ports would comprise a full Telco rack
- Modular four bus midplane architecture: Network Management Bus, Time Division Multiplexing Bus, Packet Bus, and General Purpose Bus (unused at this time)
- 10Base-T Ethernet support now, with 100Base-T promised in future release
- LAN-to-LAN Ethernet and Token Ring support for IP and IPX
- Quad modem cards with 4 ports/card
- Supports integrated analog/ISDN
- Supports proprietary x2 56 Kbps technology
- Support for RADSL-CAP promised for Q2'97
- Supports two Ethernet/Token Ring NICs and two serial interfaces
- Current List Prices (US$):

Chassis:	$ 5,490
48 modem product "bundle"	$ 44,126
24 modem product "bundle"	$ 30,506
Price/max B-channel configuration:	$101,083 (unbundled)
Price per modem	$ 920
Expected Price per modem - future	$~500 (promised)

Note:
USR's high density enhancements to the Total Control have not been formally announced at the time of this publication. All information regarding these enhancements is therefore preliminary, and subject to change.

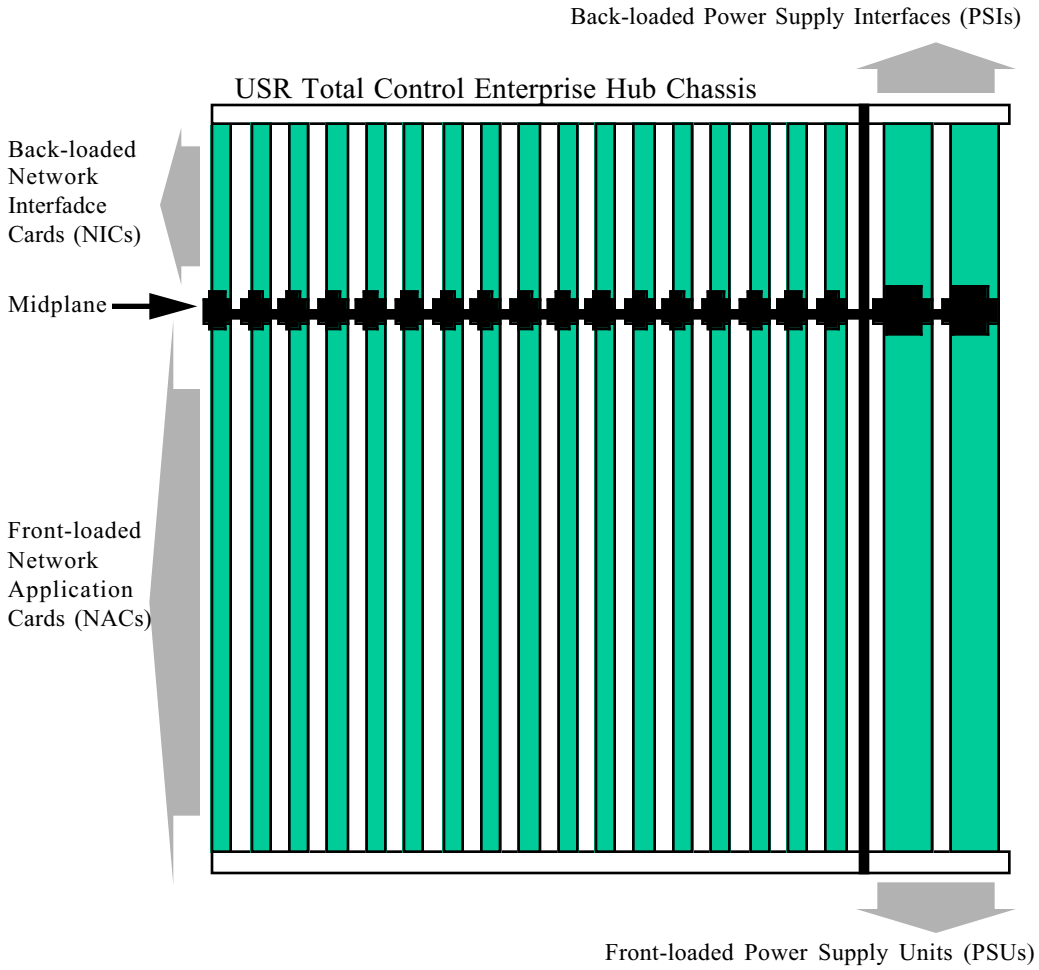

Figure 1: USR Total Control Enterprise Hub Chassis

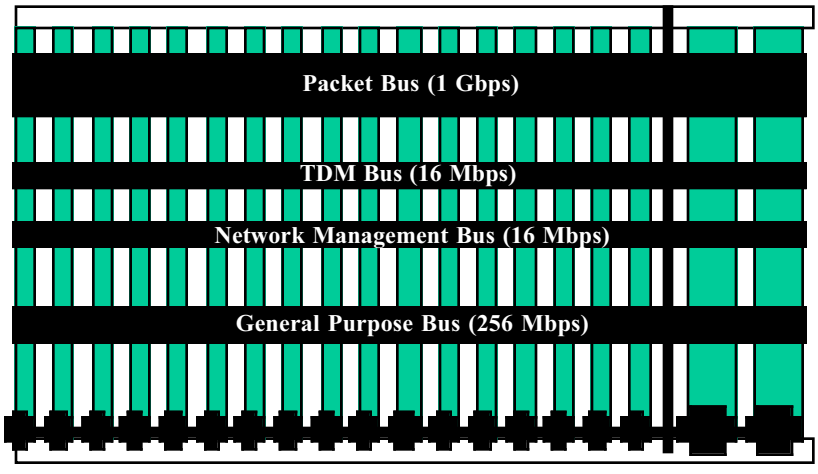

Figure 2: USR Total Control Enterprise Hub Midplane

III. Detailed Analysis of the USR Total Control

Customers look for the following combination of attributes for access concentrator deployment:

- Ability to scale, migrate with growing/changing access services
- Support for a full range of WAN connectivity options
- Comprehensive set of features to manage bandwidth efficiently
- Ability to provide "complete" solutions and next-generation technologies at a faster pace
- A solid reputation, market share and proven track record in the field
- Comprehensive security and VPN capability
- End-to-end network management and monitoring capability
- Carrier class platform support -- NEBS compliance, signaling conversion
- Low cost of ownership -- low per port prices, high product capacity and scalability (in terms of advanced features and new technologies), and full technical support

Cost of ownership is a key measurement for customers. It takes into consideration the price per port, features, provision for future upgrades as needs and technology scale, and ongoing support capability. Ascend set new industry standards with the MAX line by offering the lowest per port price compared to other leading remote access concentrator vendors while providing the most comprehensive feature set in the industry. This key differentiating factor - the ability to offer the lowest cost of ownership to end users - has established Ascend as the leader in the remote access segment. Today, the USR Total Control cost per port is at least 70% more than the MAX 400X. The USR Total Control lags behind Ascend in both analog port market share (28% vs 42.5%) and ISDN PRI port share (5% vs. 76.4%).

Ascend has consistently demonstrated faster time-to market, especially with the introduction of the high-density, carrier class MAX TNT™. With this significant introduction, the MAX line can offer the highest scalability and a range of products to facilitate full scale deployment of remote access switches. When USR follows through with announced plans to introduce a high density, six shelf Total Control, at least 9 months after the MAX TNT introduction, the MAX line will still provide more functionality in terms of bandwidth and network management, media and protocol support, and security - at a lower cost per port.

USR is expected to announce a high density upgrade for the Total Control; the upgrade will feature a new module that supports 24 digital ports and an T1/E1 port, 100Base-T Ethernet, and new, internally developed software code. With the upgrade, the Total Control's density will increase to 336 ports per chassis, and 2016 per Telco rack. The upgraded system is expected to sell for $450 to $500 per port.

Please refer to Appendix C: MAX TNT VS. USR Total Control Hub (High Density Version): Key Feature Comparison and Selling Points.

The following section provides an in-depth analysis of how the USR Total Control compares to the MAX 400X.

Price (MLP- US$)

The USR Total Control price per modem port and ISDN B-channel is high compared to the MAX 400X.

The MAX has a proven track record of providing cost-effective solutions - the most complete feature set in the industry at low per port prices for over three years. Ascend has installed more than 15,000 MAX systems, over 2.9 million ISDN PRI ports, and 1.5 million digital modem ports worldwide.

List Pricing (Bundled products)	MAX 4048	USR Total Control
Fully configured system for maximum analog ports	$26,400	$44,126
Price/modem port	$550	$920

List Pricing	MAX 4004	USR Total Control
Fully configured system for maximum ISDN PRI B channels	$18,500 (4 ISDN PRI/box, 96 concurrent sessions)	$59,520 (10 ISDN PRI/box, 230 concurrent sessions)
Price/B-channel:	$193	$259

Scalability/Flexibility

The MAX line is a scalable solution that offers densities from 12 to 96 sessions/box, or 672 concurrent sessions per MAX TNT shelf (up to 4032 ISDN sessions per Telco rack).

- Until its summer release of a high density product, the USR Total Control remains unable to handle more than 48 analog modems today. In addition, one channel per PRI is dedicated to management, leaving a total capacity of only 23 concurrent digital sessions per PRI.
- A higher density modem card is promised for summer '97 that would enable 336 modems/box - but, given the problems USR had with releasing its x2 modems on schedule, this release date may not be met. (x2 was promised for January 1997, but actually released for the Courier modem and Total Control Hub products in March, 1997)

MAX 400X	USR Total Control Hub (current)
Up to 96 or 120 (E1 version) concurrent sessions/box	230 concurrent ISDN PRI sessions/box
Up to 96 analog modems/box	48 analog modems/box
Up to 4 T1/E1s or PRIs	2 T1/E1s or 10 PRIs
BRI support	No BRI support
Single Ethernet	Two Ethernet /Token Ring
Simple upgrade from 48 to 96 users via hash code	Upgrades beyond 48 users are promised, but not available at this time; upgrade will be hardware based
Can take up to six option cards for multimedia integration, etc.	No option cards available at this time
Scale to carrier class solution with MAX TNT that can provide 672 sessions per system	Claims 6 shelf Telco rack will support up to 336 analog/ISDN sessions/rack when released (summer 1997)

WAN Connectivity

Customers - Enterprise or Carrier/ISP - require a multitude of WAN services. The MAX supports the most complete set of WAN connectivity options in the industry.

- USR Total Control's WAN support is limited to leased T1/E1 and Frame Relay
- USR Total control does not support T1/E1 to PRI conversion

WAN Connectivity Features	MAX 400X	USR Total Control Hub
Supports Switched 56 (2&4 wire)	**Yes**	**NO**
Supports leased lines T1/E1	**Yes**	**Yes**
Supports channelized T1/E1	**Yes**	**NO**
Supports Switched 384, 1536	**Yes**	**NO**
Supports low speed sync. serial (up to 8 Mbps)	**Yes**	**NO**
Supports Multirate (i.e., Nx64)	**Yes**	**NO**
Supports ISDN BRI S/T and U	**Yes**	**NO**
Supports modem dialout via Telnet	**Yes**	**NO**
Supports fax modem dialout	**Yes**	**Yes**
Supports modem dialout pool	**Yes**	**NO**
Provides PRI-to-T1/E1 conversion	**Yes**	**NO**
Supports Frame Relay	**Yes**	**Yes**
Supports V.110	**Yes**	**Yes**

Bandwidth Management and Control

Bandwidth management and control represents the feature set which allows a product to effectively manage the network bandwidth and to support protocols and standards. These combined capabilities determine how efficiently a product manages the LAN/WAN interfaces.

- USR Total Control does not have the MAX's breadth and depth of bandwidth management features
- USR Total Control does not support Multichassis MP/MPP; The MAX features MAX Stack, which maximizes bandwidth availability by enabling multiple MAX WAN access switches to function together as one logical switch for Multilink PPP calls

Bandwidth Management and Control Features	MAX 400X	USR Total Control Hub
T1/E1 drop and insert capability	**Yes**	**NO**
Dynamic IP assignment pools	**Yes** using Network Address Translation (NAT) and spoofing	**NO**
Multilink Protocol (MP)	**Yes**	**Yes**
Multilink Protocol Plus (MP+)	**Yes**	**NO**
Multichassis MP, MP+	**Yes**	**NO**
ISDN D-Channel Multiplexing (NFAS)	**Yes**	**NO**
Dynamic GRE tunneling	**Yes**	**NO**
IP/IPX Filtering	**Yes**	**NO**
Dynamic Bandwidth Allocation™	**Yes**	**NO**
Concurrent bridging and routing - IP, IPX and Appletalk routing and bridging of non-routable protocols	**Yes**	**NO**
Hardware compression	**Yes**	**NO**

Reliability and Investment Protection

With the transport of mission critical data, continued unprecedented growth in remote access, and fierce competition between access providers, system reliability and investment protection have become key factors in both Corporate and ISP/Carrier decision-making.

By optimizing software-hardware integration, Ascend products have a rich feature set and a high degree of functionality. In terms of software, Ascend has written over 1 million lines of code, and remains committed to providing users with the highest standards of service and upgradability. MAX software has a proven track record and has been stable in the field for over three years.

Ascend has demonstrated its commitment to providing leading edge solutions with its innovative IDSL technology and its strategy for MultiDSL implementation.

As a pioneering member of the Open 56K Forum, Ascend is committed to supporting an open 56 Kbps standard using the Rockwell/Lucent chipset, which currently represents over 70% of the modem installed base.

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- USR does not write its own code, it licenses from Livingston; an out of court settlement ends their licensing agreement in October, 1997 .

    ⇒ USR will be unable to do field upgrades to its installed base after September, 1997. Although USR will begin to ship its internally developed code, it is not clear as how and when they will upgrade their installed base. *If* they do succeed in releasing router code in this limited time frame, these changes still present a significant risk to USR's installed base, and will take a year or more to become "field tested"

    ⇒ New customers and the entire USR installed base will have to be rolled into new, unproved software

    ⇒ The USR products will all be integrated into 3Com's TranscendWare management platform sometime in the future

    The future of the Total Control software presents a clear risk to any current or potential customer

- USR manufactures its own chipsets - which represent less than 25% of the overall modem market. USR's recent introduction of a proprietary x2 56 Kbps technology threatens the future interoperability of both USR's client side modems, and their Total Control units.
    ⇒ At present, the only way USR analog modem speeds will increase beyond V.34 is if a USR modem is employed at both the client site and the access point
    ⇒ Since x2 failed to meet its release date in January 1997, and began shipping in March 1997, it has not garnered the momentum or first-to-market advantage USR had expected
- USR has promised an RADSL-CAP product but it is not available at this time

Reliability and Investment Protection Features	MAX 400X	USR Total Control
Proven software	**Yes** owns over 1 million lines of code	**NO** current code belongs to Livingston; new, unproved internally developed code is promised for future
56K strategy	Supports using K56flex, compatible with 70% of the	Proprietary 56K technology will not interoperate 70% of the

	modem installed base	installed modem market; x2 will not transfer into USR's Megahertz modem line
DSL service(s) offered today	IDSL	RADSL-CAP promised - not released
Maximum ports/unit	up to 96	32

Multimedia Integration

With the explosive growth in desktop videoconferencing and other video streaming applications, multimedia integration is becoming a key requirement for both corporate and Carrier/ISP customers. Ascend has held a leadership position in this technology for over four years and continues to support this feature in all of its product lines.

- USR Total Control does not provide any multimedia integration functionality

MAX 400X	USR Total Control
Inverse multiplexing	-
BONDING	-
Point-to-Point video conferencing	-
Campus desktop conferencing	-
RS 366 signaling	-
IP Multicasting	-

Interoperability

Ascend continues to expand the interoperability of the MAX line, by adding protocol functionality such as AppleTalk, OSPF, and RIP2.

With its 3 year track record and wide national/international installed base, Ascend can also demonstrate worldwide modem interoperability.

- USR does not route AppleTalk or support OSPF/RIP2 (no subnetting)

Interoperability Features	MAX 400X	USR Total Control
IP, IPX, Appletalk	**Yes**	***NO Appletalk***
Bridging of non-routable protocols	**Yes**	**NO**
RIP 2 Support	**Yes**	**NO**
OSPF Support	**Yes**	**NO**
Guaranteed interoperability with a number of carrier networks in over 36 countries	**Yes**	***unknown***
PAP, CHAP	**Yes**	**Yes**
PPP, SLIP, C-SLIP	**Yes**	**Yes**

Network Management

As networks grow in complexity, and network managers are dissatisfied with fragmented management systems and the lack of integrated tools that can show "the whole picture", there is a strong demand for network management tools that offer integration, scalability, and class of service functionality across multiple devices. To answer these needs, Ascend's NetClarity™ will enhance the MAX family's network management capabilities with support for: full POP management (rather than device management), multivendor router/switch support, complete discovery and mapping, and QoS reporting.

- USR Total Control does not offer end-to-end network management; its TotalControl Manager is a simple, costly, single device management platform

Network Management Features	MAX 400X	USR Total Control Hub
Total POP management	**Yes**	**NO**
Multivendor router/switch control	**Yes**	**NO**
Complete discovery and mapping	**Yes**	**NO**
Quality of Service reporting	**Yes**	**NO**

Security and Virtual Networks

To address security requirements, Corporate and Carrier/ISP customers need to 1) implement firewalls at both central and remote sites, and 2) to build highly secure intranets. The MAX is setting new standards in terms of providing comprehensive security and integrated dynamic firewalls including a complete RADIUS server package with a comprehensive set of extensions (120+), secure VPN, encryption and integrated dynamic firewall capability.

- USR Total Control does not meet the minimum standards for comprehensive security - Total Control does not provide extended RADIUS functionality, encryption, or an integrated, dynamic firewall. It has just announced a VPN strategy, but it is unclear as to its availability at this time.

Security and Virtual Network Features	MAX 400X	USR Total Control Hub
Comprehensive set of RADIUS extensions like Data Filters, Call Filters, Generic Filters, etc.	**Yes** (120+ extensions)	*Limited*
VPN capability via ATMP, PPTP and L2TP	**Yes for over one year**	**Yes (recently announced)**
Encryption	**Yes**	**NO**
Secure Dynamic bandwidth allocation (bringing additional B channel securely and fully authenticated)	**Yes**	**NO**
PAP, CHAP for PPP	**Yes**	**Yes**
Security Dynamics, TACACS, TACACS+, Digital Pathways	**Yes**	**NO**
Dynamic Firewall support	**Yes**	**NO**
Integrated Firewall capability	**Yes**	**NO**
RADIUS password encryption	**Yes**	**NO**

Carrier Network Support

NEBS compliance, a standard used by many telephone companies is also being used by ISPs and corporate customers to ensure that their vendors meet some of the most rigorous standards within the industry. The MAX was the first NEBS-compliant WAN access switch.

Similarly, global certifications are standard requirements for international customers. The Ascend MAX products have been certified by carriers in over 36 countries.

Many users require support for signaling conversion, multiple carrier switch signaling and global network certifications. Ascend supports these features in the MAX product line to make services more flexible and ubiquitous via a single point of access. This is one of the major advantages of the MAX 400X when a customer considers international deployment.

- The USR Total Control does not support signaling conversions at this time

Carrier Network Support Features	MAX 400X	USR Total Control
NEBS certification	**Yes**	**Yes**
Global certification (over 36 countries)	**Yes**	*unknown*
Cellular service interface	**Yes**	**Yes**
Multiple carrier switched network signaling	**Yes**	**Yes**
DS0 cross connect	**Yes**	**Yes**
Signaling conversions (PRI to T1/E1, D4 to ESF)	**Yes**	**NO**

Summary: Cost of Ownership

Cost of ownership is a key metric for end users. It takes into consideration the price per port, features offered, ongoing support capability, and provision for future upgrades as needs and technology scale. Ascend continues to set new industry standards with the MAX line by offering the lowest per port price compared to other leading remote access concentrator vendors while providing the most comprehensive feature set in the industry.

The USR Total Control has low value for the price as compared to the MAX 400X for the following reasons:

- Limited scalability/flexibility
- No BRI or Switched 56 support
- Limited bandwidth management; no Multilink Protocol Plus or Multichassis MP/MP+/BACP support
- Questionable investment protection
    - Future code in jeopardy
    - Delayed, limited xDSL support
    - Proprietary 56K with limited interoperability in the installed base
- No multimedia integration option
- Limited protocol support
- Single device network management
- Minimal security capability
    - No comprehensive RADIUS
    - No integrated/dynamic firewall
    - No encryption

MAX 400X	USR Total Control
• Lowest per port price for both analog and ISDN in the industry	• Over 70% higher cost per analog port and 35% higher cost per ISDN B- channel than the MAX 400X

IV. Performance Analysis

Independent tests were conducted in early 1997 to determine the actual performance capabilities of the MAX 400X product and how it compares to the USR Total Control.

The tests were conducted by the Tolly Group, a nationally recognized independent test agency. These performance tests were set up to accurately replicate the performance evaluation on remote access servers reported by Data Communications magazine in October 1996.

Test Environment

This test was intended to accurately measure the aggregate throughput and throughput per client of the remote access system under test, up to a maximum of 23 PC clients dialing in to access the central server over an ISDN PRI line. The clients and the server were set up to handle UDP-based (298-byte packet size) transactions.

The client PCs dialed the system under test via a PBX using external analog modems. The system under test was connected to an Ethernet switch, which in turn was connected to the central server. A network analyzer was connected to the Ethernet LAN between the system under test and the Windows NT server (using an Ethernet concentrator). The test bed is illustrated in Figure I.

Hardware/Software used

1. A single Windows NT server – Sun Sparc
2. Client PCs – Win 95 Cubix PC systems
3. Client analog modems (one per client PC) – Practical Peripherals
4. POTS PBX – Lucent Definity
5. Traffic Monitor that can provide cumulative bytes, relative time, and frames per second – Network General Sniffer
6. Ethernet switch – Xylan Omniswitch
7. Remote Access Concentrator device(s)
8. UDP Frame Generator – NSTL Blast

Note: In order to be consistent with and accurately replicate Data Communications magazine evaluation, the same frame generator software used in Data Communications test was purchased from Data Communications and used in these tests.

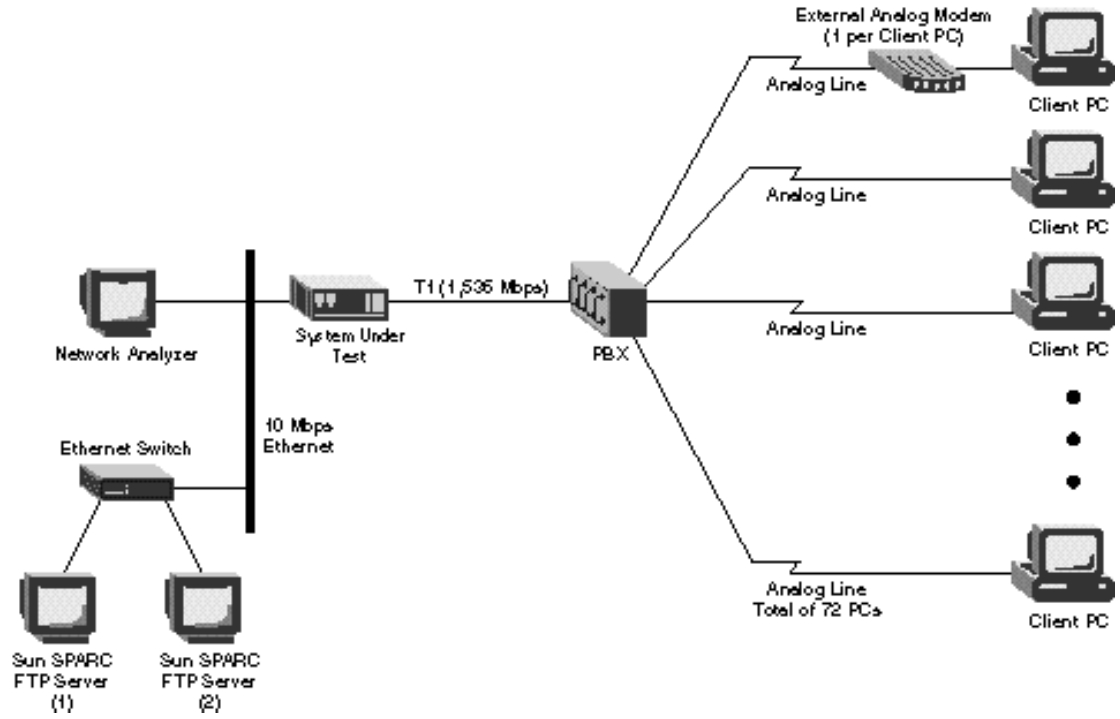

Figure I. Performance test bed

Test Methodology

Each client PC logged into the central server via the system under test using Windows 95 dial-up networking software for each session (data points were 1, 2, 4, 8, 16 and 23 PC sessions). One application was used throughout the testing: a UDP traffic generator that runs in a DOS window under Windows 95 and Windows NT, generating 298 byte UDP frames (as measured by the Network General Expert Sniffer) with 60 msec delay between frames, the same as in the Data Communication testing.

Once a PC logged in, the UDP traffic generator was started. After all the clients started running the application, the network analyzer was used to measure the aggregate throughput of the system under test. Aggregate throughput was measured as the total uni-directional bytes transferred to the server over a period of time (measured in seconds). Throughput measurements were taken with compression disabled on the system under test, the remote clients and the modems.

Key Note:
The above methodology was used to accurately replicate the test performed by Data Communications magazine in October 1996. Also, the above methodology was used for all of the devices under test - MAX 400X, Shiva LRAS, Cisco 5200 and USR Total Control. It should be noted that all the latest software/hardware versions, as of Jan. 1997, were used on the competitors' devices.
Test Results

Test No.	**Total # sessions**	**MAX 400X aggregate throughput**	**MAX 400X TPT/client**
1	1	28.37	28.4
2	2	56.74	28.4
3	4	113.00	28.1
4	8	225.64	28.2
5	16	457.96	28.6
6	23	654.86	28.5

Table A – MAX 400X Performance results (Throughput in Kbps – TPT)

Test No.	Total # sessions	MAX 400X	USR Total Control	Theoretical Limit
1	1	28.37	28.44	28.8
2	2	56.74	56.38	57.60
3	4	113.00	113.12	113.3
4	8	225.64	225.77	230.4
5	16	457.	450.46	460.8
6	23	654.86	395.74	662.4

Table B – Competitive Comparison – Aggregate Throughput Performance in Kbps

Test Conclusion:

These test results from the Tolly Group radically contradict XXCAL/USR results reported in the press in April 1997.

The Tolly Group's tests show that USR Total Control's performance peaked at 16 users, while the MAX scaled flawlessly, very nearly approximating the theoretical limit. For further authentication, the Tolly Group test results were verified by one of USR's own VARs.

There were obviously some problems with the XXCAL/USR test methodology: **in fact in their own report, the USR Total Control Hub demonstrates severe performance degradation on downloads with more than 20 concurrent sessions.**

Note: The Tolly Group performance test above employed old software code. Please refer to the most current (5/97) performance test for the MAX 4048 in Appendix B for further demonstration of the MAX's performance capabilities using current code.

V. Selling Against the USR Total Control

A. Ascend MAX Competitive Advantages - " The Silver Bullets"

- **High degree of scalability and flexibility**: Ascend is the leader in providing scalable and flexible access concentrator solutions. The MAX product line provides scalable and flexible configurations from eight to 672 modems, up to four T1/E1s/ PRIs, and T3 connections - covering a wide array of customer needs
- **High density modem integration and mixed analog/ISDN sessions**: Ascend's MAX line can integrate up to a maximum of 72 modems (672 with the high end MAX TNT) and provide up to 96(T1) or 120(E1) concurrent sessions (672 with the MAX TNT) of analog/ISDN
- **Most comprehensive set of security features** including fully integrated, dynamic firewall capability, VPN, encryption, and extended RADIUS dictionary (over 120 enhancements)
- Guaranteed interoperability with a wide number of modem manufacturers and carrier networks including carriers in over 36 countries
- **Proven track record and investment protection**: Ascend has the largest installed base of integrated access switches, with over a 76% market share, and has been shipping high density access concentrators for over three years. Customers can be assured of investment protection because of Ascend's commitment to developing scaleable, compatible and high performance platform solutions
- **Low Price/High Value** in terms of features and functionality
- **Support for all WAN access protocols** - Switched 56, DDS 56, T1/FT1, E1, ISDN BRI and PRI, and Frame Relay
- **Multilink Protocol Plus (MPP) and Multichassis MP/MPP support:** With the introduction of MAX Stack, a feature which maximizes bandwidth availability by enabling multiple MAX WAN access switches to function together as one logical switch for MP, MP+ and BACP calls, Ascend has clearly established itself as the only remote access vendor that provides comprehensive bandwidth management features. For example, a single incoming MP call that requests greater bandwidth is given additional unused channels anywhere in the stack. MAX Stack reduces the complexity and increases the simplicity of provisioning access to multiple central site WAN access switches
- **IP Multicast support**
- **Field tested VPN support**
- **Open 56K support using the K56flex technology** that is compatible with over 70% of the installed modem base
- **MultiDSL strategy and product availability** that allows for flexibility and migration options as xDSL services evolve. The MAX product line supports IDSL, SDSL, RADSL-CAP and RADSL-DMT.

B. Summary of Major Weaknesses -- USR Total Control

Code Uncertainty: US Robotics will not be able to do field upgrades to current software after September 30, 1997. USR's newly developed router code will not be field tested for at least one year. At the same time, 3Com has promised to integrate all USR/3Com products onto the TranscendWare management platform. *There is a significant risk and uncertainty associated with these changes* - they affect USR's installed base, as well as potential new sales. The change represents a huge task that will severely tax engineering, sales, and support capabilities.

It is important to emphasize this significant unknown : the future of the code for the Total Control Hub presents a clear risk to any current or potential customer - an opportunity for Ascend to win in competitive selling situations.

Interoperability: USR's stance on 56K - its significant investment in a proprietary technology and refusal to join the Open 56K Forum - weakens the ability for x2 modems to actually connect at speeds approaching 56K today or in the near future. The Total Control is similarly limited as to its interoperability with over 70% of the ISP's client market.

USR has not released any testing results to demonstrate the true performance of the x2 technology.

Other limitations:

- *Not scalable*: while units can be "stacked" to provide up to 576 concurrent sessions (or more in future releases), there is no bonding of B-channels between multiple chassis
- *Lower density*:
  ⇒ maximum of 48-336 (future) analog modems/box vs. 12 -672 for the MAX family
- *Limited security*: no dynamic firewall capability or encryption, limited RADIUS
- *No track record with high-end access switches* - limited ISP experience: In Q4'96 USR had only a 5% share of total ISDN PRI ports, and less than 30% of analog ports. Ascend dominates the access concentrator market with over 76% share of the ISDN PRI ports, and over 42% of analog ports. (Dell'Oro Group, 2/18/97)
- *Incomplete WAN access service support* - cannot support Switched 56 or ISDN BRI
- *Inadequate bandwidth management and control* - No MP+ or Multichassis MP/MP+, no support for ISDN D-channel multiplexing, Dynamic GRE tunneling or dynamic B-channel allocation
- *Limited interoperability* - no OSPF or RIP2 support
- *No multimedia integration support*- no IP Multicast

C. Responses to USR's Attacks on the MAX

USR's Attack on the MAX	Ascend Counter-Attack/Position
"*The USR Total Control can compete with the MAX and MAX TNT, and USR will introduce a high density concentrator in late summer."*	Ascend has been providing scalable and modular WAN access systems for over 3 years. The MAX line provides scalable and flexible configurations from 8 to 72 modems (up to 672 with the high-end MAX TNT system) and up to 4 T1/E1 or PRI connections thus covering a wide array of customer needs. USR is late to market with its high-density platform, which still is not announced, much less field proven.
"USR was first to market with 56 Kbps technology that is software upgradable, and thus lower cost to implement."	Ascend's MAX platform is built to be scalable, modular and "future-ready". Ascend supports open standards, and helped pioneer the Open 56K forum. The MAX supports Rockwell/Lucent's new K56flex chipset Rockwell/Lucent chips represent over 70% of today's installed modem base. Ascend's 56 Kbps speed is achieved by means of a unique hierarchical Digital Signal Processor (DSP) architecture that sends calls all the way through the central site in pure digital format. The long-term viability of the Series56™ Digital Modems is assured through a software-based upgrade method that allows ongoing compliance with 56K standards.
"USR is gaining momentum in the ISP/Carrier segment."	Ascend has the largest installed base of remote access concentrator systems (over 15,000 systems installed worldwide and over 76% of ISDN PRI ports) and has been shipping remote access concentrator products for 3 years. Ascend pioneered many of the leading ISDN and hybrid remote access technologies and continues to provide state of the art products that meet the most demanding needs of customers worldwide. Ascend's MAX products have been installed in 34 of the 40 largest ISPs in the world.

"USR is gaining market share in the ISP."	In fact, Ascend took analog port market share away from USR in the second half of 1996 - USR lost over 15% share. At the same time, Ascend has maintained its dominance in ISDN with over a 76% market share in access concentrator ISDN PRI ports. (Dell'Oro Group, 2/18/97)
"USR Total Control can be stacked to compete with the MAX TNT."	USR Total Control does not offer MP+ or Multichassis MP/MP+/BACP capability. MAX Stack is a feature which maximizes bandwidth availability by enabling multiple MAX WAN access switches to function together as one logical switch for Multilink PPP calls. Ascend has clearly established itself as the only remote access vendor that provides comprehensive bandwidth management features needed for high density solutions. While USR claims it will have a stackable Telco rack solution, this system's actual capabilities remain to be seen, and proven in the field.
"USR is introducing a high-density system to compete with the MAX TNT."	Another "me-too" product - another late market entry. The Ascend MAX TNT began shipping in December 1996, 8- 9 months before the promised release date for this new, untested product.
"Independent XXCAL tests performed in January/February 1997 demonstrates MAX performance degradation and questions future performance with 56K modems."	• The USR-sponsored XXCAL test design is flawed. In fact USR's own performance showed considerable degradation as users scaled. (Please refer to the competitive document: US Robotics' Total Control Performance Testing Press Release *4/21/97*) • Recent testing of Ascend's new Series56 Diigital Modems demonstrated excellent linearity as client users scaled (Please refer to Appendix B)
"The MAX has performance problems, as shown by the Data Communications tests performed in October 1996."	In fact, the Tolly Group's test (1/97) validated Ascend's performance and scalability claims, and demonstrated USR performance peaked at only 16 sessions with an aggregate throughput of 450 Kbps ; USR's throughput *dropped* to 396 Kbps when scaled to 23 clients**.**

VI. Selling Against US Robotics and 3Com

A. Company Analysis *Before and After* the 3Com Acquisition

Company Overview - USR Before the 3Com Acquisition:

Prior to the announced acquisition by 3Com, USR's days sales outstanding (DSO) had been increasing - implying that modems were not moving off retailers' shelves. Evidently, despite revenues of over $2.3 billion in FY'96, US Robotics had a only $18.7 million in the bank signaling a cash flow problem. USR's president announced that the company's future revenue was dependent ISPs and consumers' acceptance of x2 . Analysts and investors took this statement to mean that USR's main business - modems - was flat and USR had put all of its future success on its new, still-unproved x2 technology.

Overall USR Strategy Prior to 3Com Acquisition:

USR's strategy was to leverage its strength in dial-up modem technology, customer-driven design, marketing, and distribution channels to expand into a wide variety of network access products targeted at all key access points.

Strategic initiatives included:

- Invest in proprietary x2 56K modem technology
- Invest in wireless, switching, xDSL and cable modem technologies
- Build market share in served markets
- Broaden market base to address all levels of communication from dial-up modem segment to communications centers and network service providers
- Expand distribution channels for network systems products
- Expand international sales force, sales offices and distribution channels
- Pursue additional strategic alliances and acquisitions
- Emphasize R&D to control key technologies:
    - ◊ be first to market
    - ◊ be the low cost provider

USR Product Lines/Target Markets Prior to 3Com Acquisition:

Product Line	Positioning/Target Markets
Network Systems Products	
Total Control Hubs	High-density platform for LAN/WAN integration targeted at Enterprise Central sites or Service provider POPs
EdgeServer	Front-end integration of servers and other communication devices for remote LAN users to access to multiple file servers
TotalControl NetServer	Multiport access for small networks and SOHOs
Courier desktop modems	Software upgradable analog modems for "advanced" consumers, home offices, and corporate desktops
TotalSwitch LAN switch Hub	Segment or replace shared networks
TotalContol Modem pools	Affordable integrated modem pool for small offices or branch offices
Personal Communications Products	
Mobile Communications	Cellular capable Megahertz modems and PC cards
Handheld Product	Pilot Organizer palm-size personal communication device
Telephony Products	ConferenceLink full duplex conference speakerphones and digital phones
Sportster* and DataBurst modems	Analog and ISDN modems/fax modems for consumers and home offices (*USR's largest selling product)

USR Sales/Distribution Strategy Prior to 3Com Acquisition:
Leverage brand recognition in dial-up modem market to expand into other network access segments. Exploit modem users' upgrade cycle by supplying timely product enhancements at low cost (high margin).

Increase sales/distribution presence abroad (increased international sales force by 20% in FY1996). Add offices in Pacific Rim countries.

High selling related expenses for x2 introduction will impact revenues in the first half of 1997. Many company objectives rely on market acceptance of x2

USR Financial Performance Prior to 3Com Acquisition:
US Robotics revenues grew 122% in FY'96, to just under $2 billion; growth in the most recent quarter ended March 30, 1997 was 7% over the previous quarter. The company attributes its FYQ1'97 growth to an 80% increase in unit sales in its PC related product lines - not their network systems business. In their press release, the company indicates that it has committed resources to increasing international sales in the networking systems business group. Network Systems Products accounted for 26% of revenue for the quarter ended March 30, 1997.

USR Market Penetration to Date:
- Majority of business is in Corporate (non-ISP/Carrier) market
- Low international penetration (22% of total revenues in FY'96, 33% of revenue for FQ2'97

USR Market Share Indicators:
Based on the latest Dell'Oro Group worldwide port shipment data for Q4'96, USR has a 28% share of the Access Concentrator market in terms of analog ports, but only a 5% share of ISDN PRI ports. In the Access Server segment, the USR share was 6%.

USR Major Competitors:

Network Systems Business: Ascend, Cascade, Lucent, Cisco, Shiva

- In their quest to diversify away from the personal modem market into network access, Ascend and Cisco are USR's major obstacles; in the corporate enterprise market, Cisco, 3Com and Shiva have the penetration and brand recognition to be prime competitors.

Desktop Modem Business: Hayes, Zoom, Best Data, Cardinal, Diam, Boca Research, Motorola

- Since the majority (80% or more) of USR revenues are based on its PC-related modems, fax modems, and phones, the majority of their competitive focus has been on protecting this business.

Handheld Business: Casio, Hewlett-Packard, Pscon

USR After the Acquisition

The new 3Com will have revenues estimated at over $5 billion; while they will supply diverse networking products- including network adapters, desktop modems, PC Card modems, workgroup switching, shared media hubs, and remote-access products - *50% of their combined revenue will be generated by adapters and modems.*

3Com has announced that the new company will be drop the USR brand name, and organize around customer segments rather than product/technology segments. The enterprise systems business unit will sell hubs, switches, routers and network management software; the carrier systems business unit will sell remote access equipment to service providers, and the client access business unit will sell the USR LAN/WAN client-side access products and 3Com adapter cards across all customer segments.

In terms of remote access, at news conferences on the day of the announcement, 3Com's CEO stated that Total Control will be the "dominant platform" and the AccessBuilder 8000 will disappear.

Wall Street was not receptive to the merger announcement; analysts do not expect a significant positive impact to 3Com's bottom line, since there is little room for operational cost savings.

Challenges for the newly combined company:

1. Will the company retain its key executives and development teams?
2. How efficiently will the two companies integrate management, technical services, sales and distribution?
3. Will the combined companies be quick to market, or bogged down by their size and cultural issues?
4. Where will they place their channel emphasis? How will they maintain channel loyalty?
5. How will they resolve the proprietary x2 vs. Open 56K issue?
6. How will they integrate the AccessBuilder line with USR Total Control?
7. How will 3Com-USR network management products be integrated? Analysts expect integration to take at least 12-18 months.
8. How will the two companies ward off customer fears and maintain margins? It is likely they will encounter demands for discounts and free upgrades from customers that are fearful of upgrade, integration and migration costs.

There are reports that many customers are delaying USR orders, and shopping for alternative vendors. These customers are worried about the x2, remote access, and segment emphasis (i.e. will the 3Com/USR emphasis be on ISP/Carrier or consumer/retail?).

B. Attack Strategies

Major 3Com/USR Weaknesses

- **The combined companies do not have the presence, or the product, to compete in the high-end carrier class access and routing arena. (50% of their business is in adapters/modems)** In Ascend's strongest market segment - access concentrators - both companies lost significant share in 1996. 3Com lost 14% (falling from 15.4% to 1.6%) in analog port share, and USR lost 16% in analog and 3% in ISDN port share. Although the Total Control Hub will survive the fallout, 3Com isn't bringing any ISP/Carrier presence or technical innovation to the table to improve upon dragging performance. Neither company has high-end products or technology to be a real threat for Ascend's MAX TNT and GRF™ product lines

- **Both companies have immense challenges in consummating the deal**
  The management teams at both 3Com and USR are under tremendous pressure because of the likelihood of increased disharmony among shareholders and outside parties disrupting the merger process. So, between now and the expected closing date, the management ranks of both companies will have to divert their attention from day-to-day operational issues to ensure that the merger goes through. This is an opportunity for Ascend to exploit in selling situations because this complex merger scenario can be expected to cause customer concerns, employee dissension and poor operational execution.

- **Channel uncertainty also represents an opportunity for Ascend**.
  VARs are wondering what will happen to their discount structure and what will be the impact on technical and sales support. Ascend must reinforce its excellence in technical and sales support, the GET FLEX program, product reliability, consistency, and market leadership. Since neither 3Com nor USR is known for innovation or creating markets, and undoubtedly organizational change will slow new products, Ascend can use this time of uncertainty to further emphasize its leadership position as a provider of emerging high speed technologies and networking solutions.

- **x2 is a gamble**
  Many believe that x2 helped drain USR's cash, and has been poorly managed since its announcement. In March/April '97, x2 upgrades applied to recently purchased Courier and Sportster modems, and Total Control (x2 can not be imported into the Megahertz modem at this time - it still uses a Rockwell chipset) - there are reports that x2 client software is still problematic. Performance at 56K is not possible - under the best line conditions, the modems support speeds up to 48-53K downstream - but the interoperability with the ISP/modem installed base remains a key issue going forward.

  Open 56K forum member companies like Ascend that support Rockwell/Lucent's K56flex chipset began shipping client and digital modem cards almost concurrent with the USR actual product release. These products are compatible with over 70% of the installed modem base, and will present an open path toward implementing the standard, when it is reached.

  Ascend is the only vendor that has a strategy in place for ISDN, 56K, and MultiDSL; this is a competitive advantage as it represents investment-protection for both Carrier/ISPs and corporate POPs.

- **The new 3Com has no technology and "system-level" track record to provide a seamless single vendor solution**
  The networking industry is warming up to the trend toward a single vendor providing fully integrated networking solutions from LAN-to-WAN. Although this trend is likely to continue for a while, it is important to realize that technological advantage will almost always prevail. In other words, customers are unlikely to assign tremendous value to a "single vendor proposal" if the vendor's equipment does not fully satisfy all critical customer needs and/or does not incorporate the most advanced technology. Ascend has consistently demonstrated that it can provide high value solutions that meet the critical needs of customers now and in the future.

Ascend Responses to Perceived USR Strengths and Marketing Claims

USR Claims	Ascend Response
"Expertise with dial-up modems translates to an expertise in analog-to-digital, and digital-to-analog signal conversion and high speed data transmission."	Ascend writes its own code, and has been the leader in hybrid ISDN/analog access for over three years. Ascend will change the face of the digital modem market with its monumental GET FLEX upgrade program for over 1.5 million digital ports.
"Commitment to own/control core technology" makes USR fast to market with low cost, high margin products."	USR does not own its Total Control code - it has been licensing router code from Livingston.
"Brand recognition in the dial-up market will propel sales in other remote access segments."	The USR brand name is being dropped! Ascend has a proven track record in access concentrators and has been shipping flexible, scalable product for over 3 years. Ascend has shipped over 2.9 million ports to ISPs .
"USR can build revenues by exploiting the user's "trade-up" cycle - providing timely upgrades and enhanced functionality and speed at higher prices."	USR has been successful at following this path in the client modem market; now, by introducing proprietary 56K technology that will **not** interoperate with over 70% of the market, USR is jeopardizing the trust of the marketplace.
"USR has a strong customer base in the corporate remote access market - in Fortune 1000, universities, financial, and government institutions."	Ascend's scalable MAX line is represented in 34 of the top 40 ISPs worldwide and over 76% of ISDN PRI access ports; as corporate networks require scalable, flexible, secure network access, the new Ascend MAX 20XX and 40XX products provide the depth and breadth required at a low cost.
"USR Total Control has over 1 million installed ports"	Ascend has installed over 2.9 million ports, and over 1.5 million digital modems worldwide.

Appendix A: USR Financial/Marketing Snapshot Prior to 3Com Acquisition

Category	Number/Description
Revenue (Growth%)	$1,977.5 million (122%) FY'96;
Net Income Before Interest and Taxes (Growth %)	$301.9 million (177%) FY'96;
Gross Margin (%)	42% FY'96;
R&D expense (as % of Revenues)	$109.4 million (5.6%) FY'96
Sales and Marketing expense (as % of Revenues)	$271.6 million (13.7%) FY'96
Employees	~6,300 1,230 in sales and marketing
Offices	Worldwide
Year founded	
Type of products	Remote access; LAN hubs, servers, switches; palmtop computers; wireless devices; telephony devices
Customer base	Consumers, Fortune 1000; financial, educational and government sectors
Distribution	2 tier, VAR, Retail, Direct, and OEM
Key Alliances	
Recent Acquisitions	8/96: Scorpio Communications, to extend ATM switching past the Ethernet LAN to Corporate backbone and WAN access 2/96: AmberWave, a vendor of workgroup LAN switches to provide low-cost LAN switching products for corporate customers

Appendix B: MAX 4048 Performance with 56 Kbps Modems

Purpose

This document and the test results presented herein are intended to communicate the actual performance capabilities of the MAX™ 4048* with new DM-16 cards (Series56™ Digital modem modules) and software code revision 5.0Ai9. The performance testing was conducted in a way to replicate a dial-in environment using 56K client modems.

Test Environment

This test was intended to accurately measure the aggregate throughput and throughput/client of the remote access system under test (MAX 4048) up to a maximum of 48 PC clients dialing in to access the central server over two PRI lines. The clients and the server were set up to handle FTP transactions.

The client PCs dialed the system under test via a PBX using external analog modems running at 56 Kbps. The MAX 4048 was connected to an Ethernet switch, which in turn was connected to the central server. A network analyzer was connected to the Ethernet LAN between the system under test and the Windows NT server. The test bed is illustrated in Figure 1.

Performance was measured as a per client throughput of live FTP transfers with all clients running simultaneously over two PRI lines.

Hardware/Software used

1. A single Windows NT server – Sun Sparc
2. Client PCs – Windows 95 Cubix PC systems
3. Client analog modems (one per client PC) – Diamond SupraExpress and Zoom Telephonics running at 56K speed (All RAM-based K56 modems)
4. POTS PBX – Lucent Definity
5. Traffic Monitor that can provide cumulative bytes, relative time, and frames per second – Network General Sniffer
6. Ethernet switch – Xylan Omniswitch
7. Remote Access Concentrator device – MAX 4048 with Series56 DM-16 cards

*The MAX 4048 is a fixed-configuration box consisting of 48 modem ports (three DM-16 cards) and two PRIs.

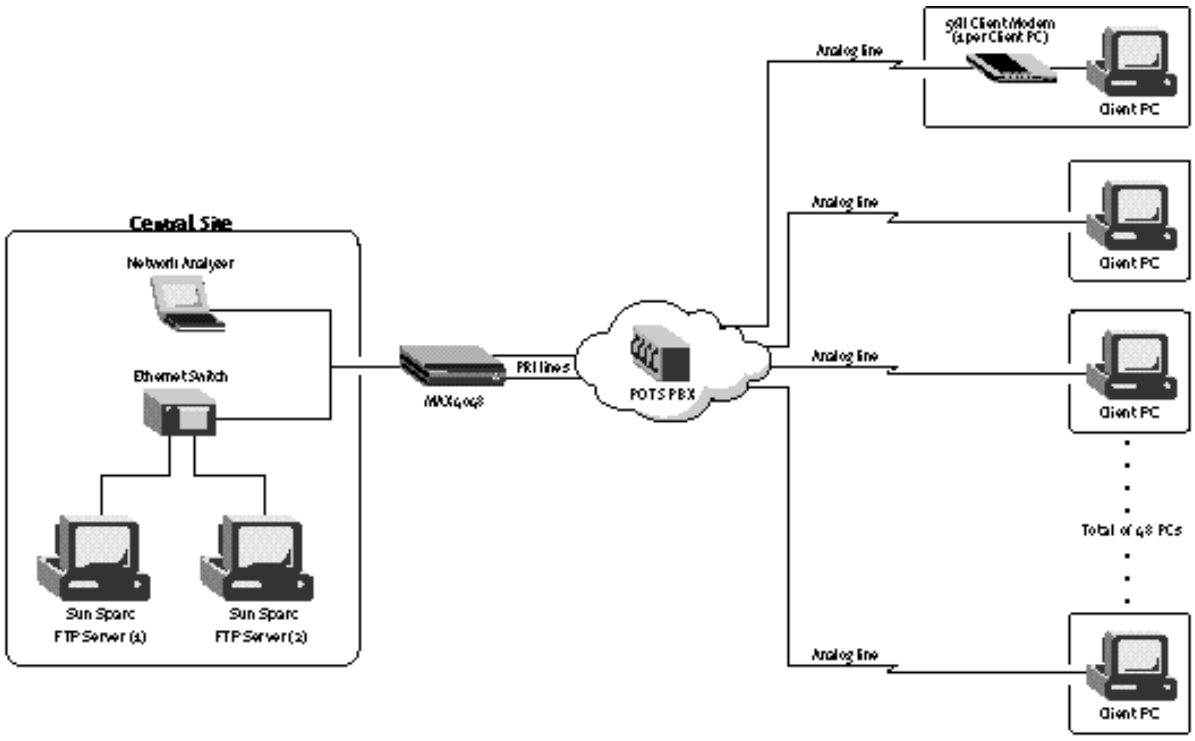

Figure 1—Performance test bed

Test Methodology

Each client PC logs into the central server via the system under test using Windows 95 dial-up networking software.

For each data point session (data points were 1, 4, 8, 16, 24, 32, 40, 47 PC sessions). Once a client PC logs in, the automatic script initiates the call, sets up the call session, authenticates user IP address and sets up a FTP file transfer session. After all the clients start transacting FTP files from the central server, the network analyzer, Network General Sniffer, measures the aggregate throughput of the system under test. Aggregate throughput is measured as the total number of bytes transferred to the server over a period of time (measured in seconds with three samples taken every 15 seconds). Throughput measurements are taken with compression enabled on the remote access concentrator (the system under test) as well as the remote clients and the modems.

Test Results

Total # sessions	4048 aggregate throughput (Kbps)	4048 TPT/client (Kbps)
1	71.6	71.6
2	131.9	66
4	244.2	61.1
8	391.7	49
16	817.9	51.1
24	1222.4	51
32	1704.5	53.2
40	2222.3	55.6
47	2750.9	58.5

Table A – Ascend 4048 Performance Results with DM-16 Series 56K cards

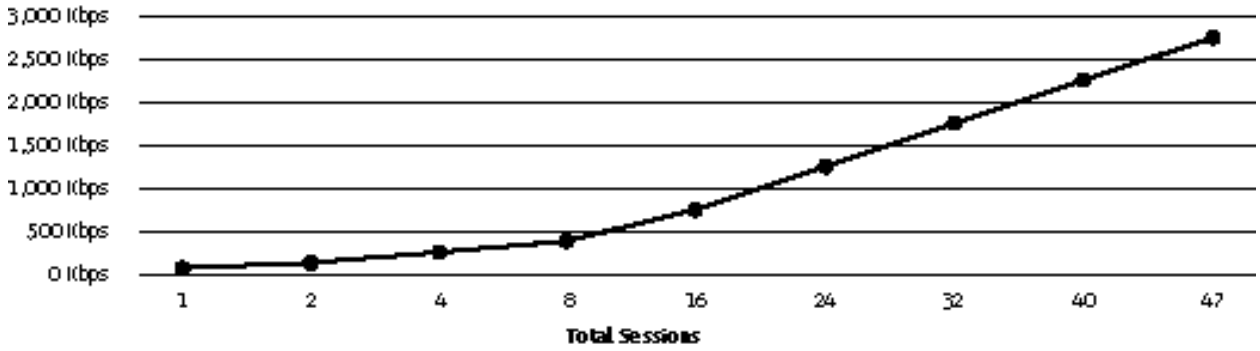

Figure 2—MAX 4048 Aggregate Throughput (Kbps)

Summary/Conclusion

The MAX 4048 with new Series56 DM-16 cards and software code 5.0Ai9 has demonstrated that the net (aggregate) throughput per system for 47 simultaneous sessions is 2750.9 Kbps and is linear as the sessions scale up (refer to Table A and Figure 2).

The per client throughput exceeds the raw link speeds of 56 Kbps (Table A) because of all the compression being turned on the client side as well as the MAX side. This data has been verified with Engineering for viability and accuracy.

Appendix C: MAX TNT Vs. USR Total Control Hub (High Density Version): Key Feature Comparison and Selling Points

Key Feature Comparison

Carrier Class Access Switches	Ascend MAX TNT	USR Total Control Hub
Capacity/Scalability		***planned not released****
Analog ports per shelf	288	336
ISDN ports per shelf	672	336
Shelves per 8 foot Telco rack	Single shelf system, 3 shelves per logical unit; 2 logical units per 8' rack	6 shelf unit
Shelf connection	100 Mbps TAXI	100 Mbps Ethernet
Total analog connections per 8 foot Telco rack	2016	2016
Total ISDN connections per 8 foot Telco rack	4032	2016
Total system capacity (analog and ISDN connections per 8 foot Telco rack)	4032	2016
WAN connectivity	T1/E1/PRI Frame Relay Serial WAN T3	T1/E1/PRI Frame Relay
LAN Connectivity	10Base-T/ 100Base-T FDDI (5-97) HSSI (6-97)	10Base-T Token Ring
Fault Tolerance/Redundancy		
Redundant power	Yes	Yes
Hot Swappable modules	Yes	Yes
Network Management		
SNMP-based	Yes	Yes
NMS	NetClarity	TotalControl Manager
Protocol Support	IP, IPX, OSPF, RIP2 IP Multicast	IP, IPX
High Speed Modem Support	K56flex,	x2 56K
	Yes (IDSL, SDSL, RADSL)	Yes (RADSL)

Selling Strategies

Carrier Class Access Switches	Ascend MAX TNT	USR Total Control Hub
Key Selling Points	• Designed for a Carrier Class environment • Proven market share leader in remote access • Market-tested system software • Supports K56flex, IDSL, and MultiDSL • Supports T3 • Supports VPN • High end IP switch (GRF) on trunk side of TNT	• Designed for hybrid ISDN/analog modem services for Telecommuting, Internet Access and LAN-to-LAN routing • Compatible with USR's 56K modem technology - x2 • Will feature rate-adaptive ADSL-CAP in future • New high density DSPs will handle two calls per modem
Key Weaknesses		• Limited presence in digital port market : only 5% market share • Limited high speed WAN support - no T3 connectivity • Limited security support (No extended RADIUS, TACACS/TACACS+, no encryption, no integrated firewall) • Proprietary x2 56Kbps technology limits interoperability with 70% of modem installed base • No IP Multicast support • Limited Carrier class serices and signaling conversion support

* USR's high density upgrade to the Total Control system is expected, but has not been announced; therefore, the above information is preliminary and subject to change