Virtual Private Network Business Case
Prepared For
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TeleChoice, Inc.

I. *Virtual Private Networks – An Overview*

The telecommunications industry has generated a new "buzz" word – Virtual Private Data Networks. A derivative of traditional voice Virtual Private Networks, data can supply corporations many of the same features and benefits that voice VPN services have delivered over time – reduced cost, closed user groups, "on" and "off" network pricing. However, as with any "buzz" word, a number of interpretations of data Virtual Private Networking have arisen – often based on the specific capabilities of the vendor or service provider. In the most general sense, Virtual Private Networks can be defined as a network service or implementation utilizing the Internet or Internet-based technologies to securely connect geographically dispersed inter- or intra-corporate business communications.

To deliver basic Virtual Private Networking services, a number of key components must be present. These components include:

- Access – dial, ISDN, cable modem, xDSL, dedicated
- Tunneling protocols – for integration of proprietary protocols and as a migration for IP v4 to v6 conversions
- Authentication – RADIUS, Lightweight Directory Access Protocol (LDAP)
- Encryption – Ipsec, DES, Triple-DES and RC4

These components, and other optional services such as Quality of Service and a number of back office functions including end-user billing and service level agreements, combine to deliver true Virtual Private Networking services as depicted in figure 1 below:

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Figure 1
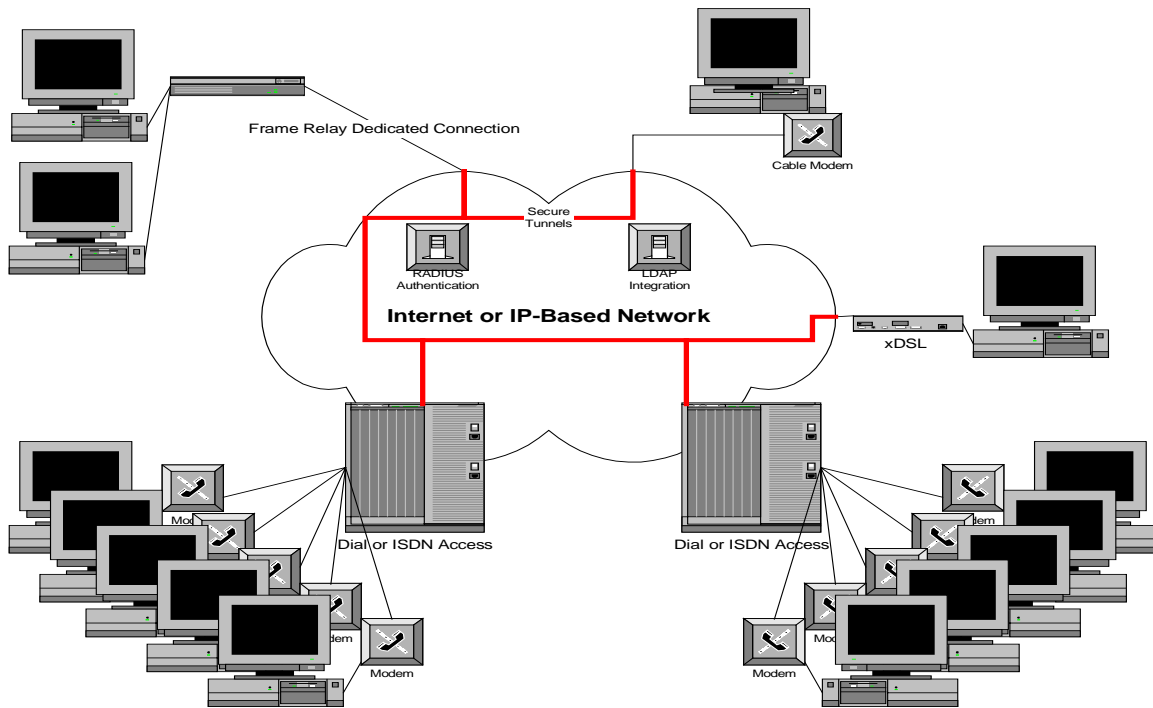
Virtual Private Network (VPN) services promise organizations of all sizes:

- Secure, economical links with business partners and franchisees
- Economical communications with remote offices
- Reduced costs for connecting to the growing number of telecommuters, mobile and remote workers.

Virtual Private Network services are also altering companies' perception of wide area networking services – from a tactical transmission mechanism to a strategic means of boosting sales, expediting product development and delivery and creating stronger business relationships.

Based on phenomenally successful Internet technologies (TCP/IP, the World Wide Web, browsers) and recent developments in tunneling (Point-to-Point Tunneling Protocol/PPTP, Layer Two Tunneling Protocol/L2TP and others) and current and emerging security standards (IPSec, Firewalls, Socks v5, VTCP/Secure), Virtual Private Networks leverage the ubiquity and uniformity of TCP/IP standards to transport data over secure tunnels that resemble, at least in function, conventional private lines.

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Corporations, frustrated by a plethora of client-server development tools, user interfaces, and networking options have turned to Internet and Web technologies) for delivery of internal information and application resources. These corporate Intranets provide:

- Database access
- Electronic messaging
- Inventory management
- Customer service
- Collaboration
- Order management
- Publishing
- Straightforward Year 2000 conversions.

This transition has resulted in:

- Growth of TCP/IP as the predominant enterprise networking protocol – more than sixty percent of all large companies utilize TCP/IP today, with a projected growth to more than three times that of IPX this year.[1]
- Intranet implementations at more than eighty percent of all companies with more than one thousand employees and fifty-five percent of all companies with one hundred to one thousand employees in 1997.[2]

With Internet technologies firmly entrenched in the system and network infrastructures of the corporation, Virtual Private Networks are the next step to extend in leveraging the Internet and its technologies to solve their business problems. Virtual Private Networks integrate the remote worker, supplier and distributor into the corporate fabric utilizing the cost-effective, standardized Internet infrastructure, while providing network service providers new service delivery and revenue generation options. Virtual Private Network products and services provide THE opportunity for network service providers to secure and expand their customer base in an increasingly competitive telecommunications landscape.

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[1] Business Research Group (Newton, MA)
[2] Zona Research
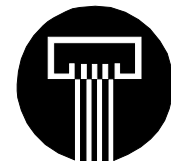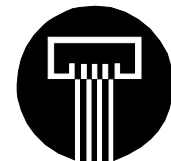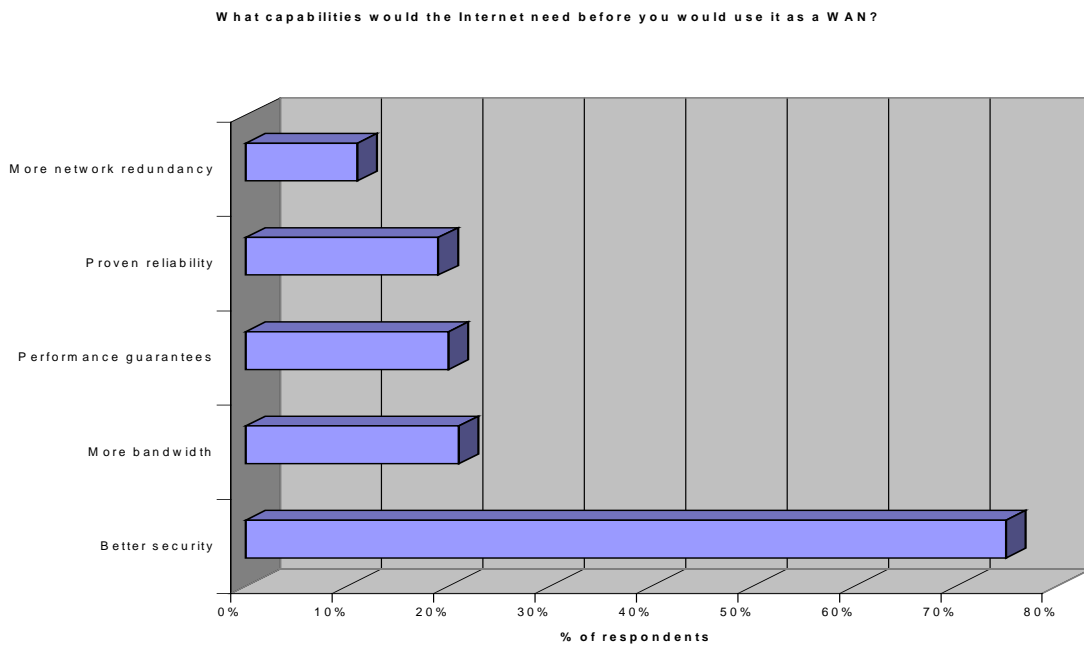
II. *Why Virtual Private Networks?*

Radical changes in the business and computing environments have resulted in the need to support:

- Remote system access by employees working at home or on the road
- Linkages with business partners for supply-chain management (business-to-business communication).

Supporting these applications and systems however, provides new and sometimes unexpected challenges for the information technology professional. Cost, interoperability, support, security, speed and integration with existing systems and protocols present barriers to implementation.

The Internet, utilizing standard protocols, interfaces and methods of content delivery is seen as a possible solution for providing remote access to business applications as well as business-to-business communications. A recent Forrester Research survey of *Fortune 1,000* companies revealed that most believe that Internet-based systems could replace other wide area network technologies, but believe added capabilities are required before they would transition their networks.

Figure 2

What capabilities would the Internet need before you would use it as a WAN?

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The growing availability of tunneling, security and service monitoring technologies is allying these concerns. The result is a groundswell of support and interest in Virtual Private Network products and services. In fact, many analysts and enterprise network and information technology managers believe that Virtual Private Networks could become a more fundamental tool than leased lines and frame relay. In fact, Infonetics Research, in a report issued in December of 1997 projects that the market for Virtual Private Network products, systems integration and network services will explode at a nearly sixty-fold rate between 1997 and 2001 from $205 million to $11.9 billion.
Figure 3

Projected VPN Spending

	Products	*Systems Integration*	*Network Services*
1997	**$15M**	**$45M**	**$145M**
1999	**$275M**	**$425M**	**$1.67B**
2001	**$1.19B**	**$1.18B**	**$8.85B**

Source: Infonetics Research

Additionally, carriers and Internet Service Providers are entering the market with products that promise 99.7% availability (or higher) and cost savings of up to $60,000 per month for a one thousand-user network. These carriers and Internet Service Providers are even more optimistic about the growth of Virtual Private Network service revenues, envisioning a market between $10 and $20 billion by 2001.

It is clear that Virtual Private Network products and services are capturing the attention of enterprise network and information technology professionals, systems integrators and network service providers. But, what has forced this focus on Virtual Private Networks? What key business benefits are corporations seeking that are not available utilizing existing wide area network technologies?

    1.   Virtual Private Networks and the Enterprise

The key forces behind adoption of Virtual Private Networks in the enterprise are:

- Remote Access
- Business-to-Business Communications.

Each of these areas present corporate network and information technology managers with a number of unique technical, support and business challenges which have been unmet by existing network products and network service provider services. Support for remote access and business-to-business communications has been complex, costly and difficult to implement and maintain. When compounded by the highly publicized "skills crunch" in networking and information technology – outlined in a recent *Business Week* article (March 10, 1997) – the resulting unmet business requirements force corporations to delay or suspend technology implementations which could yield in significant competitive advantage (see Figure 4 below).

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Figure 4

Business Requirement	Result
• Need to monitor inventories and finances in real time. • Need to have an Internet presence and participate in electronic commerce. • Need to convert existing systems to accommodate year 2000.	✓ **Companies worldwide spent an estimated $50 billion in 1997 to link computers (build networks).** ✓ **760,000 people are currently working for network-related companies alone.** ✓ **More than 600,000 technical positions currently unfilled, with the cost of acquiring and retaining "network savvy" personnel rising by twelve to twenty percent per year.**

What is a service provider to do? Let's look at remote access and business-to-business communications and find out.
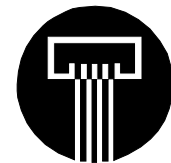
2. Remote Access

The corporate requirement to link suppliers, sales and marketing personnel as well as the rapidly growing number of telecommuters (twenty-five million by 2000[3]) extends the system provisioning, management and support services required of information technology professionals. Linking the remote computing power of robust desktop and laptop systems requires new processes, applications, hardware, software and expertise as well a greater concentration on the needs of the user versus the system. The corporation that distributes, utilizes and controls information best, at headquarters, in communications with suppliers and customers, as well as with employees in remote, mobile, or telecommuting roles will be in the best position to survive in a rapidly changing global economy.

And yet, information technology managers have been caught somewhat off guard. Managers have to support portable personal computers, configure and maintain operating systems and applications for remote user systems, as well as select and manage data communications links and equipment.

A number of thorny technical and support issues therefore confront the corporation seeking to implement systems that provide remote workers equality – the ability to access the same resources and run the same applications as their local counterparts, without penalty. Issues include:

- Access speed and technology
- Capitalization of central site equipment (Forrester Research estimates that it costs more than $200,000 in equipment to support two thousand remote users)
- Integration of multiple protocols (TCP/IP, IPX, AppleTalk, VINES)
- Multimedia
- Authentication
- Encryption
- Directory services
- Ensuring quality of service – especially for multimedia applications such as IP voice or video
- Help desk support
- Software distribution and version control
- TCP/IP address management
- Asset management
- End user billing.

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[3] JALA International, Inc.

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Support inconsistency and complex technologies have also resulted in high remote worker support costs. As these costs have been identified (including hidden costs such as the performance degradation of data applications over telephone lines as well as the tendency for telecommuters to rack up outside copying and fax charges), corporations have sought an effective method of supporting their remote workers while ensuring their integration into the overall corporate network and computing architectures. The tables below illustrate the typical costs for a single remote or telecommuting employee (see Figure 5 below):

Figure 5

White Collar Remote Worker Costs

Type of Cost	Onetime Cost	Annual Cost
Support	$200	$385
Network	$20	$156
Home Setup	$3,816	$565
Corporate Setup	$108	$16
Total	$4,144	$1,122

Telecommuter Costs

Type of Cost	Onetime Cost	Annual Cost
Support	$500	$347
Network	$203	$1,282
Home Setup	$3,522	$494
Corporate Setup	$237	$35
Total	$4,462	$2,158

Source: Forrester Research

As workforces grow ever more distributed, the possibility of turning to a network service provider to support these services becomes attractive. In addition to significant cost savings (Forrester Research estimates that companies can save up to sixty percent off the cost of remote access by using TCP/IP network services instead of purchasing routers and access servers of their own – see Figure 6 below), the requirement to provide end user "hand-holding" is reduced, allowing information technology personnel to concentrate on supporting complex corporate applications. Additionally, the user can simply call a local point of presence that maintains equipment and links to the company.

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Figure 6

Traditional Remote Access
$3 million

Internet Remote Access
$1.2 million

2,000 Users

	Traditional	Internet
T1/E1 lines	*$48,000*	*$68,400*
Routers, servers	*$208,000*	*$44,800*
Phone, ISP charges	*$2.1 million*	*$1.08 million*
User support	*$600,000*	*$0*

Source: Forrester Research
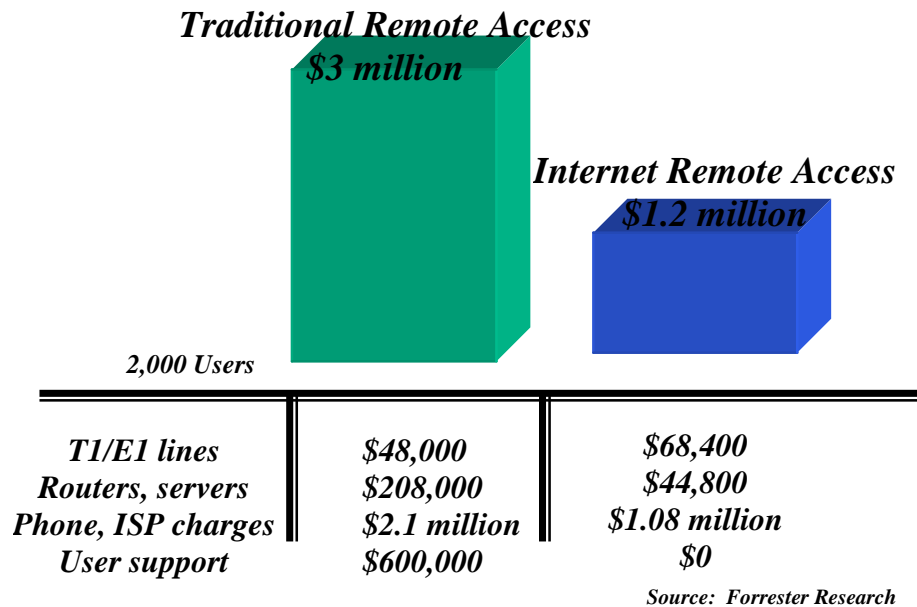
Virtual Private Network services have been designed to provide corporations a comprehensive, cost-effective solution to supporting the needs of widely dispersed user communities.
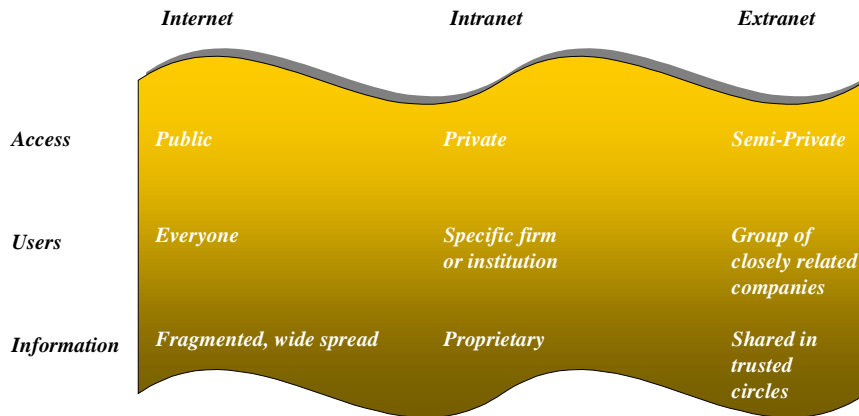
3. Business-to-Business Communications

Since the inception of Electronic Data Interchange (EDI) more than thirty years ago, corporations have sought ways to streamline inventory and distribution cycles. Bar coding and EDI fueled efficient distribution by enabling trading partners to quickly communicate what will be shipped where and when.
But, only an elite few have reaped the benefits of these technologies (one hundred thousand of six million businesses in the United States currently utilize EDI[4]).

The rise of networked "open platform" computing represents the opportunity for corporations to extend beyond themselves to multiple organizations that must collaborate communicate and exchange documents in order to achieve joint goals, not just transmit purchase orders and invoices. The new extended network, or Extranet, takes advantage of Internet technologies, existing corporate Intranets (focussed on internal communications and applications), and extends those systems to enable collaborative business applications such as electronic commerce and supply-chain management as depicted in Figure 7 below:

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[4] *ComputerWorld,, April 1997*

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Figure 7

	Internet	Intranet	Extranet
Access	*Public*	*Private*	*Semi-Private*
Users	*Everyone*	*Specific firm or institution*	*Group of closely related companies*
Information	*Fragmented, wide spread*	*Proprietary*	*Shared in trusted circles*

Key to the success of these business-to-business networks are:

- An in depth knowledge of the required application and logistical linkages
- Supporting technologies and services required to make the Internet "industrial strength".

Online products are handled differently than traditional ones. A company sends out a description of a product via the Internet; a consumer responds with an order, prompting the vendor to manufacture the product with modifications to suit individual tastes; prompting the vendor to order additional parts and/or services from their supplier chain; and the product is shipped directly from the factory floor to the buyer's business, or eventually home. The result is more efficient production and distribution – and in theory – lower prices.

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Figure 8

Functions:

•**Purchasing**
•**Accounts Payable**
•**General Ledger**
•**Inventory**
•**Asset Maintenance**
•**Cash Management**
•**Order Management**
•**Production Scheduling**
•**Claims Processing**

Fax/Mailbox/Agent Interface/EDI Multimedia

Corporate Inter/Intranet in concert with Network Service Provider

Manufacturer/Retailer

Vendor

Customer

Bank

Transportation Carrier

Insurance Companies

Government

Health Care Providers

Trade Exchange

Electronic Catalogs

Credit-Card Authorization

Trading Partners

To support these complex systems however, technologies and services must be provided to ensure:

- Consistent and robust access
- Integration of multiple protocols
- Multimedia support for IP voice and video
- Robust security – authentication, verification and encryption
- Linkages between directory services
- Reliability and performance – including service level agreements in such areas as latency, availability and service support
- Billing to the correct party for subscribed services only.

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Without each link in the technology, service and support chain in place, the dream of the networked "community of interest" and true business-to-business communications, will be shattered. However, the technology challenges inherent in supporting the services outlined above as well as finding and retaining the skilled individuals required to provide these services are almost insurmountable.

Outsourced services appear to be the answer; however, no network service provider currently concentrates on meeting these enterprise needs. Why then, should your company provide Virtual Private Networking services?

4. *Virtual Private Networks and the Network Service Provider*

The landscape of the network service provider is rapidly changing. Enterprise network managers have more options than ever before populated by:

- Telecom megaliths – large providers able to offer Internet access, World Wide Web hosting, data connectivity, voice/video telecommunications and other services
- Telecom upstarts – up and coming providers that can offer more specialized, state-of-the-art services, such as multi-megabit-speed access connections, international private lines to and from hosted Web servers, direct access to the Internet backbone networks and private Network Access Points (NAPs).

Additionally, traditional local service providers (Incumbent Local Exchange Carriers or ILECs, Ameritech, Bell Atlantic, SBC, GTE) are entering the long distance market and traditional long distance inter-exchange carriers (IXCs, AT&T, Worldcom, Sprint, MCI) are buying local carriers or entering local markets. Then there are the upstarts – Internet Service Providers are providing voice services through IP voice, utilities are becoming local and Internet Service Providers, wireless companies are providing wireless local loop services, competitive local exchange carriers (CLECs) are popping up at an amazing rate (more than five hundred CLECs currently are in operation), satellite systems such as Iridium and Teledesic are on the horizon and cable providers are offering Internet access for their installed base.

What's a network service provider to do? Profitability is getting squeezed. Competition is pitching more bandwidth, lower costs, fixed monthly access pricing. How can a network service provider retain and grow their customer base, eliminate churn, increase profitability and provide innovative services that customers want and they can provide?

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Virtual Private Networks may be an answer. As outlined above, corporations are struggling with providing the strategic network services required by telecommuters, remote workers and business partners. And, they see the promise of Virtual Private Networks and Internet-based technologies as the solution to their strategic network requirements. Virtual Private Networks are a significant means to retain and grow customer base, eliminate churn, increase profitability and provide innovate services that customers need and want – NOW! It is hardly surprising that Infonetics Research believes that the Virtual Private Network services market will reach $8 billion by 2001.

Virtual Private Networks can come in many "flavors" enhancing service and revenue opportunities for network service providers. An example might include (see Figure 9 below):

- Network design and implementation services
- Authentication services
- Tunnel management services
- Directory services
- Encryption services
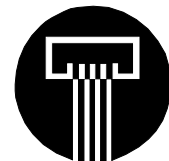- Customer premise equipment provision and management.
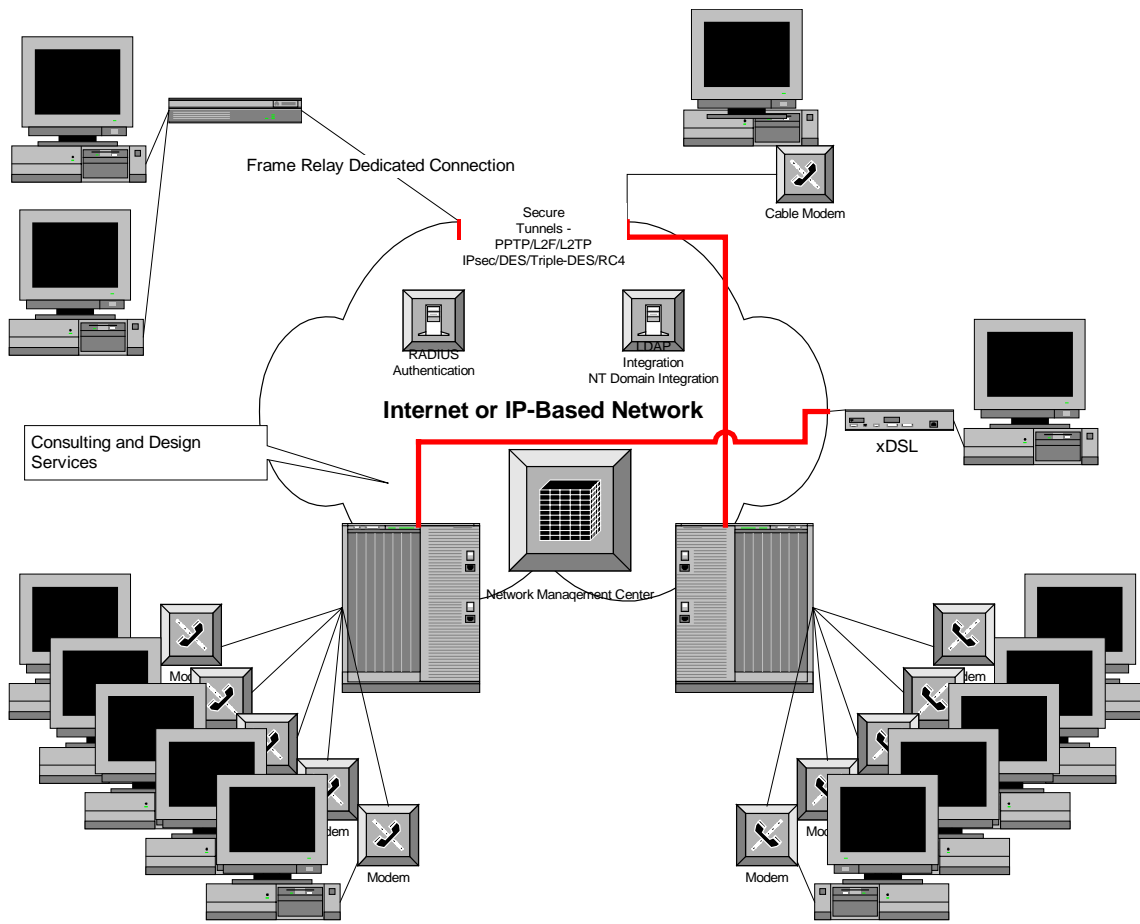
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Figure 9

Virtual Private Networks provide you, the service provider a means of generating significant and highly profitable revenues. A sample high level return on investment for a 2,000 user Virtual Private Network is outlined in Figure 10 below:

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Figure 10

Component	Revenue/Cost Per Year
Revenue	
T1	$102,600
Access	$480,000
Equipment Management	$10,000
Help Desk	$300,000
Internet Accounts	$480,000
Sub Total	*$1,372,600*
Costs	
T1	$48,000
Access	$360,000
Equipment	$40,000
Equipment Management	$4,000
Help Desk	$144,000
Internet Accounts	$30,000
Back Office Support	$100,000
Sub Total	*$726,000*
Total Gross Profit	*$646,600*
Gross Margin	*47%*

Your customers will also realize savings from your service – an easy sales strategy. For again, a 2,000 user Virtual Private Network, "build your own" costs would total $6,456,000. Customers savings realized through a VPN service would be $5,083,400 per year.

Virtual Private Networks also allow service providers to build innovative and highly profitable adjunct services which will grow customer base, eliminate churn and position the provider to enter new markets. Increased revenues and profitability can be realized through such new services as:

- Managed services – provide end-to-end Virtual Private Network services to enterprises including managed:
  - ✓ Customer premise equipment
  - ✓ Security services
  - ✓ Directory integration and Domain Name services
  - ✓ Software distribution services
  - ✓ Asset management services
- Extranet "affinity" programs
  - ✓ Sign up a "supply chain" and offer access and managed services as a total package, increasing revenue impact and account stability
- Consulting services
  - ✓ Network "health checks"
  - ✓ Network design
  - ✓ Security planning, audits and more
- Wholesale access to junior providers

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- New customer premise equipment offerings and programs.

More and more corporate network managers are becoming service managers, not managing the local and wide area network as much as the contractual arrangements with network service providers. As changes in telecommunications markets and technologies occur, these managers are seeking means of enhancing and optimizing their networks. Selecting the vendors and services that best meet their corporate requirements will be what they're paid for. Will they choose you?
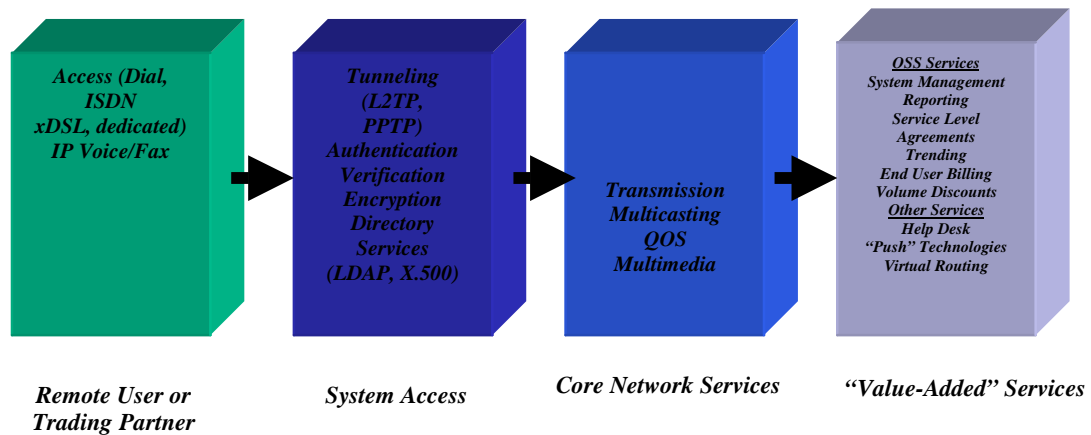
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III. *Virtual Private Networks – Technologies*

A number of technologies must be integrated to provide "true" Virtual Private Network services. They range from simple dial or dedicated access to encryption, policy management, directory integration and system management. The successful network service provider will provide a unique set of technologies, integrated to meet the needs of corporations struggling with telecommuter or remote worker projects and/or those faced with the challenges of tightly integrating their supplier or distribution channels with them.

Key building blocks to a successful implementation are modeled in Figure 11 below:

Figure 11

Access (Dial, ISDN xDSL, dedicated) IP Voice/Fax	*Tunneling (L2TP, PPTP) Authentication Verification Encryption Directory Services (LDAP, X.500)*	*Transmission Multicasting QOS Multimedia*	*OSS Services System Management Reporting Service Level Agreements Trending End User Billing Volume Discounts Other Services Help Desk "Push" Technologies Virtual Routing*
Remote User or Trading Partner	**System Access**	**Core Network Services**	**"Value-Added" Services**

An expanded view of these technologies is provided below:

- Access technologies which support a range of speeds including:
  - ✓ Traditional modem access (28.8 Kbps, 56 Kbps [V.90])
  - ✓ ISDN Basic Rate Interface (128 Kbps)
  - ✓ Digital Subscriber Line/xDSL (various types/speeds as standards arise – 128 Kbps to more than 6 Mbps)
- Tunneling protocols for integration of proprietary protocols and standard Internet-based services (Point-to-Point Tunneling Protocol [PPTP], Layer Two Forwarding [L2F], Layer Two Tunneling Protocol [L2TP]
- Authentication systems including:
  - ✓ Remote Authentication Dial-In User Service (RADIUS) – against Unix accounts or an independent database
  - ✓ Internal or External Lightweight Directory Access Protocol (LDAP)
  - ✓ Microsoft authentication against an NT Domain
  - ✓ Token-base systems (Security Dynamics, AXENT)
- Encryption and Key Management
  - ✓ IPsec, including AH, ESP and ISAKMP/Oakley

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- ✓ DES, Triple-DES and RC4 (up to 128-bit key length)
- Filtering
    - ✓ Individual User or Group Profile
    - ✓ Source and Destination IP address
    - ✓ Port, service and protocol type
    - ✓ SYN/ACK bit
- Quality of Service
    - ✓ Resource Reservation Protocol (RSVP)
    - ✓ Priority Levels
    - ✓ Connection Prioritization
- Directory Services Integration – Lightweight Directory Access Protocol (LDAP) providing stand-alone directory services or lightweight access to X.500 enabled directories.
- Multimedia Support – IP voice and/or video
- Web-based system management – providing easy access and other quality of service metrics as well as system alarms and configuration tables ensuring a reliable end user implementation.
    - ✓ Service level agreements and reporting – latency, availability, utilization, service management
- Accounting – internal and external RADIUS database support. Event, system security and configuration accounting as well as automatic archiving.

Without the above outlined technologies in place, the success of any Virtual Private Network service implementation is limited at best.

Additional services that corporations may require or that may boost revenues provided by Virtual Private Network services include:

- Help desk services for both the network and applications
- Software distribution and version control of all software applications
- Asset management (laptops, personal computers, printers, modems, ISDN terminal adapters, xDSL gear, fax machines, software, other office equipment and accessories)
- End user or company by company bill back capabilities
- Discounts for entire supply or distribution chain.

The technologies and services outlined above will deliver Virtual Private Network services that will meet the expectations and needs of the more than twenty-five million telecommuters and six million U.S. businesses by the year 2000. Will your company be the leading provider of these highly profitable and ubiquitous services?

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