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WHITE PAPER

The CLEC Business Opportunity in Managed Port Services

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1. Executive Summary

Internet Service Providers (ISPs) are major consumers of leased lines and other network services from Local Exchange Carriers (LECs). This market segment is already significant and profitable for LECs – and is growing by leaps and bounds. This paper discusses an emerging new opportunity for LECs and Competitive LECs (CLECs) to serve this lucrative ISP market – the Virtual POP managed port service offering.

CLECs can create a profitable new business in offering Virtual POP managed port services to ISPs, recovering their initial capital investment within the first year. The service arrangement offers many compelling benefits for the ISP, including extended local calling areas, controlled communications costs, nationwide coverage, high speed networking options, and reduced ownership risk. Indeed, with rampant growth continuing unabated in the Internet, ISPs simply cannot afford to overlook this capable and cost-effective network solution for their subscribers. As a future-proof networking solution for ISPs, Virtual POP managed port service will emerge as a major element of the $100 billion public network market in the year 2000.

Many of the nation's largest ISPs no longer own and operate their networks, electing instead to outsource their networking functions to network operation experts – smaller ISPs are expected to follow suit. Under the service arrangement, the ISP agrees to outsource certain network functions to the CLEC, including their dial-up modem access and their high-speed connection to the internet backbone. These ISP network functions are replaced by a single IP service connection (between the ISP and the CLEC) and monthly Virtual POP service fees. The service fees are based on the ports and the internet backbone connectivity requirements of the ISP. With the CLEC providing the ISP's Internet backbone connection, the ISP sees only that traffic destined for its own Web, e-mail or other network services. All other traffic is routed to and from the Internet backbone without passing through the ISP.

By offering Virtual POP services, the CLEC is positioned as the ISP's network provider and can therefore take advantage of future subscriber demand for increased network speeds and enhanced IP services. As the ISP's subscribers continue to demand faster network access, the CLEC can respond quickly by adding xDSL, Frame Relay and other high-speed access services as well as faster internet backbone connectivity to the initial Virtual POP service offering. The CLEC can use the same Virtual POP network infrastructure to offer dial-up and dedicated data services to high margin business customers as well, augmenting existing voice service contracts and differentiating their overall service offering from the competition.

The $100 Billion New Public Network Services Opportunity

New Public Network services, which include Virtual POP service offerings, are anticipated to exceed $100 billion in revenue in the year 2000. This revenue is distributed as follows:

- *$13.7B for digital access*
- *$29.6B for Internet access*
- *$28.0B for intranets and extranets*
- *$6.3B for enterprise VPNs*
- *$28.0B for IP voice and fax*
- *$1.5B for integrated messaging*

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2. The Internet Market

The growth of the Internet continues at an unprecedented rate. According to a survey by CommerceNet/Nielsen Media Research, nearly one in every four adults in the United States and Canada is online. International Data Corporation estimates that there are currently around 100 million Web users worldwide. Killen & Associates projects that 250 million users will have access to the Internet by the year 2000. While estimates vary among research firms, one forecast is quite consistent: strong continued growth of the Internet and data services.

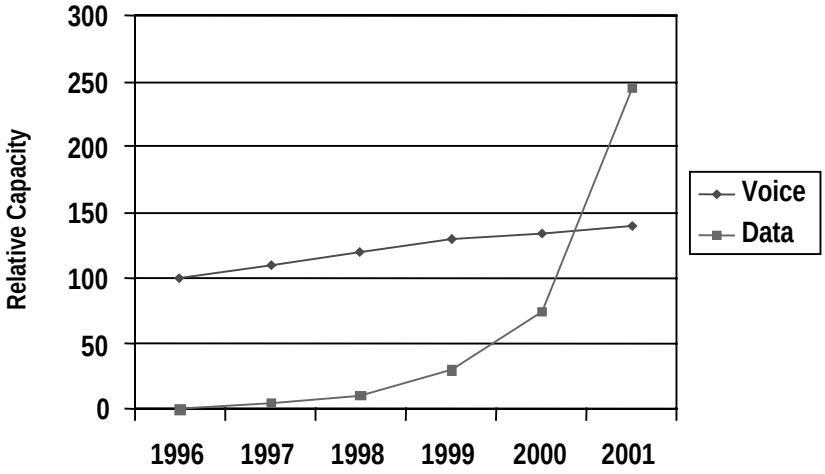

Figure 1 – Voice vs. Data Services Growth (Source: TeleChoice 1998)

Data Services Growth Outpacing Voice Services

While voice communications is a big business, it is a relatively static one. Lack of differentiated services force carriers to compete with each other by cutting prices and/or adding extra services such as voice mail at no charge. Voice service contracts are now temporary and easy to change with long distance customer churn rates of 30-40%, while data service contracts are long lasting. TeleChoice Inc. predicts that data traffic volumes will surpass voice by the year 2001, with voice over IP changing the rules of the game. Forrester Research further predicts that virtual private networks (VPNs) will become a $60B business by 2000 – up from almost nothing today – which will increase demand for Internet and other public data network services. Gasman Research conservatively estimates that data services will surpass voice services within the next six or seven years in the local access market, and become a $100B dollar market in ten years. The message is clear: Carriers need to garner a piece of the growing data services market.

Ascend's Experience in the Public Network

As a leader in public networking, Ascend understands both the needs and the requirements for wholesale network access. New Public Network solutions from Ascend are deployed by:

- *85 of the 100 largest ISPs worldwide*
- *over 1500 of the larger regional ISPs*
- *60% of the IP switching and Frame Relay backbone providers*
- *6 of the 7 US RBOCs*
- *95% of the largest PTTs in Europe*
- *10 of the Top 12 CLECs in the U.S.*

Today's Internet Service Provider Market

ISPs represent a diverse group of companies that now number nearly 8,000 worldwide – some 5,000 of which are in North America – providing Internet access to individuals and businesses. Internet service providers typically establish multiple local dial-up Points of Presence (POPs), where their customers can establish connection to the ISP's servers and to the internet backbone with local dial-up or dedicated access.

Types of Internet Service Providers

Internet Service Providers are broken into three classes: Local, Regional and National providers. A fourth on-line service category is the Value Added Network (VAN) providers including America Online, Microsoft Network, and Prodigy. The local and regional ISPs have been quite successful at winning new subscribers in their local areas, offering competitive access options, web hosting, and technical support to subscribers within reach of their POPs. Likewise the national ISPs and the national VANs have been successful at rolling out services to the entire U.S., winning a large share of the residential user market. Each has their own recipe for success.

- **Local ISP –** The Local ISP maintains one to five POPs in their local area, serving primarily residential subscribers. They offer dial-up analog modem and ISDN access options supporting Internet e-mail, WWW information and entertainment services. The majority of their subscribers use dial-up analog modems to connect to e-mail, Web information and entertainment. Some small ISPs are still using traditional analog modem banks.

- **Regional ISP –** The regional ISPs serve both the residential and business markets, offering Internet e-mail, advanced web hosting services, and some enhanced-IP and value added managed network services. Some of their customers have dedicated 56 Kbps, ISDN and higher speed data connections to the ISP. Some ILECs operate a regional ISP business.

- **National ISP –** The National ISPs provide individuals and corporations with dial-up and leased line access nationwide. The National ISPs also act as a hub for backbone services to the local and regional ISPs. All of the major IXCs operate their own national ISP business.

- **Value-Added Network (VAN) – On-Line Service Providers –** CompuServe and America Online are the largest value-added network ISPs, providing their own online content in addition to Internet access. These companies offer a wide range of products, and the majority of their Internet customers today are individuals. The major VANs can also be considered as National ISPs, because their subscribers have local dial-up access throughout North America. The leading VANs are heavy users Virtual POP managed port services today.

Challenges Facing Local and Regional ISPs

With the commercialization of the Internet, the local/regional ISPs have become the cornerstone for access, yet the National ISPs are steadily gaining market share. Regional ISPs have been very successful in building their subscriber base thus far, however with their success, the regional ISPs have come under pressure from the four Cs: capital, competition, costs and capacity.

Capital – In surveying the local/regional ISPs, their number one challenge is keeping up with the market demand. They have minimal access to capital for expansion. Their profits generated are used for expansion, but their explosive growth still outpaces their capacity.

Competition – The regional ISPs are competing creatively, with many offering usage-based pricing in addition to monthly and yearly flat-rate pricing. They are seeing their margins erode, however, in an effort to stay competitive with very competitive pricing from the VANs and national providers. The local/regional ISP monthly flat rates now average about $20.00 per month for basic Internet access, and usage based pricing varies.

Costs – The local/regional ISPs have four major cost areas, listed in order of importance:

- ***Communications –*** The greatest monthly recurring expense incurred by an ISP is for twisted pair POTS or channelized T1/PRI access lines. ISPs also incur monthly charges for WAN data services, such as Frame Relay, for their high-speed connection(s) to the Internet backbone NAPs. Availability of T1/PRI circuits from LECs is often slow, and WAN circuit delays can equate to lost business, an opportunity cost to the ISP.

- ***Personnel –*** Most Regional ISPs run a lean operation with a limited number of highly skilled technical people managing their configuration. Nevertheless, staffing represents the second largest expense area for all ISPs. Technical staff members are key to the ISP's success and are, therefore, heavily recruited in the industry. Training and retaining these key employees is a major – and costly – challenge for ISPs.
- ***Facilities –*** The Regional ISP typically uses rented office space and/or co-locates with the ILEC. Their facilities generally have limited rack space and lack redundant power and HVAC. The larger local/regional ISPs have the additional burden of supporting multiple locations. Facility costs for larger Regional ISPs can run as high as 10% of total expenses.
- ***Equipment –*** The typical Regional ISP configuration consists of access concentrators and routers, along with servers for security, accounting, Web sites and e-mail. The access concentrator, because of all it does, is normally the most expensive piece of equipment in the Regional ISP POP. A capable access concentrator is a complete edge communications solution for a wide variety of WAN services, including analog modems, ISDN, Frame Relay, leased lines and even DSL (digital subscriber lines).

Capacity – Capacity is a critical issue with ISPs today, and the problem is not limited to capital constraints. Neither the business nor the residential customer will tolerate repeated busy signals while attempting to access the Internet. A well-known example is the problem America Online experienced after changing its pricing to a flat rate structure. AOL significantly increased its subscriber base, but could not expand its infrastructure quickly enough to meet the greater demand. The problem soon evolved into an issue of lead times for systems and circuits, which grew up to three months long.

Challenges Facing ILECs and CLECs

ISPs are not the only ones with capacity problems. With the growing demand for T1/PRI services from ISPs, LECs are now running out of voice switch capacity. The PSTN was originally designed for voice calls with an average hold time of three minutes. Data hold times are at least 10 times longer – and getting longer by about 10% every six months. Even today, Web surfing sessions can last hours. So ILECs are being forced to enhance or expand their networks with the addition of costly voice switch capacity. And to compensate for the additional expense, some ILECs are now seeking higher tariffs on T1/PRI services to the ISPs. For the very same reasons, many CLECs are choosing not to provide T1/PRI services to ISPs at all. Many ISPs now experience long delays in having new lines provisioned from the LEC, and this is an opportunity for CLECs.

3. CLEC Opportunity – Offering Virtual POP Managed Port Services to ISPs

Offering Virtual POP managed port services to ISPs is indeed the next major data service revenue opportunity for CLECs. ISPs get the subscriber access ports and, optionally, the Internet backbone connection they need, wholesale from the CLEC who provides one or several Virtual Points of Presence (POPs) for the ISP. The CLEC provides a turnkey solution that includes the managed ports, Internet backbone connections and network management for the ISP. The ISP's traditional networking infrastructure is consolidated into a single IP connection (between CLEC and ISP), and the CLEC then charges a monthly network service fee based on the ISP's dial-up access port requirements, and their internet backbone connection requirements.

Economies of scale in both equipment and high-speed WAN lines make the solution affordable for the ISP and profitable for the CLEC. The ISP benefits from extended calling area coverage, simplified operations, and better access alternatives for their subscribers. The ISP's subscribers will be satisfied with the increased reliability of the new CLEC managed Virtual POP access network, compared to traditional ISP managed access networks which vary in quality, reliability and availability. Because Virtual POP managed port service is a win/win arrangement that benefits the NSP, the ISP and the ISP's subscribers, Virtual POP service is indeed the future of Internet access.

Virtual POP Benefits for the ISP

- *Increases profits by saving money in several areas: staff, communications, equipment, facilities, training and maintenance*
- *Improves connect success rates with carrier-class capacity and reliability*
- *Enables support for state-of-the-art capabilities, including VPNs, 56K modems, xDSL, VoIP, multicast and more*
- *Expands the ISP's subscriber access coverage quickly and easily, with flexible port quantities in specific areas*
- *Provides "pay per use" incremental expansion of access ports*
- *Eliminates troublesome modem banks*
- *Permits use of a single telephone number for modem and ISDN users*
- *Maintains compatibility with existing Internet infrastructure and CPE*
- *Operates completely transparently to the ISP and the subscriber, including user and domain names, password databases, e-mail addresses, and so on*
- *Enables the ISP to offer additional services - previously constrained by limited capital*
- *Allows the ISP to focus on value-added services, rather than basic network access*

CLEC Profits Through Economies of Scale

Traditional modem banks have nearly become obsolete with the advent of access concentrators. Why? Because the access concentrator affords economies of scale that cut costs in half. The economies of scale in access concentrator equipment and the traffic aggregating high-speed lines which terminate on them – not to mention the daily savings in management costs – made the access concentrator substantially more affordable than the traditional modem bank approach. Accordingly, ISPs were forced to implement access concentrators in their networks to remain competitive. Just as access concentrators became an integral part of all ISP network infrastructures, the Virtual POP managed port service configuration, with the economies of scale and improved performance it brings, will become an integral part of all competitive ISP operations.

Virtual POP service takes economies of scale to the next level with *carrier-class* access concentrators supporting multiple ISPs, thousands of ports, and tens of thousands of users. Offering Virtual POP managed port service, CLECs can realistically expect to recoup the initial equipment investment within the first year and be left with a profitable revenue stream for many more years to come, as internet traffic demands continue their exponential growth. This is possible because the economies of scale are real – and substantial.

"Reciprocal Compensation" Revenues for the CLEC

Reciprocal compensation revenues can make offering Virtual POP services even more attractive for CLECs, adding a significant revenue source to the CLEC's "managed port service" revenues. Most interconnection agreements (between ILEC and CLEC) specify some type of reciprocal compensation where the carrier who terminates the call (the CLEC) must be paid a negotiated per minute fee (usually between $0.005 and $0.020 per minute) for terminating the call. Naturally, ILECs have been trying to avoid paying reciprocal compensation in every way possible. According to telecom law firm Kelley Drye & Warren LLP, over the past six months CLECs have been asking state regulators to compel payment of reciprocal compensation for ISP traffic termination – and to date, over a dozen states have issued rulings in favor of the CLECs. Though the reciprocal compensation revenue opportunity looks promising for CLECs who offer Virtual POP managed port services, the financial analysis in this report assumes a pessimistic $0.005 per minute reciprocal compensation call termination revenue for CLECs.

Virtual POP Benefits for the CLEC

The CLEC can achieve these benefits – and more – with a Virtual POP network service offering:

- *Get a "piece of the action" in the hottest market today – data services*
- *Use fewer resources from the core voice network for data calls*
- *Avoid risky ISP acquisitions and/or investments in server technology & training*
- *Make immediate use of the existing major capital investments in infrastructure capacity*
- *Generate highly profitable revenue with minimal additional capital investment*
- *Obtain incremental revenues in data services without major operational changes*
- *Provide complementary "retail" data services to business customers*
- *Become the most valuable (and profitable) element of the burgeoning VPN market*
- *Attract additional voice business from loyal data customers to turn switch capacity into switch revenue*
- *Reduce churn rate and increase market share by becoming more of a full service network access provider to the needy ISP market*
- *Obtain long-term loyal customers, rather than price-only customers*
- *Make efficient use of the CLEC's backbone data network, more traffic on it*

Serving ISPs with Improved Connectivity to The Internet Backbone NAPs

Since the early 1990s both local exchange carriers and CLECs have been flooded with transport circuit service orders from ISPs looking to connect to the nearest internet backbone Network Access Point (NAP) or Private NAP (PNAP). Most ISPs are leasing a Frame Relay T1 connection to the internet backbone, which is easily shared amongst many ISP subscribers. As the bandwidth required to support popular internet applications continues to grow, ISPs are looking for faster, more reliable connections to the internet backbone. The Virtual POP service offering positions the CLEC to offer enhanced internet backbone connectivity services to ISPs. With minimal provisioning changes, the CLEC is able to satisfy ISP service requests for increased internet backbone connectivity speeds, redundancy and improved peering arrangements.

Offering Dial-up Data Networking Services to Businesses

Once the CLEC has implemented a Virtual POP service architecture, and has rolled out the “managed port service” offering, they can sell dial-up data services to local business customers who don’t want to manage their own remote dial-up networks. The financial model for selling managed port service to businesses is the same or better than the model in Appendix A for selling managed port services to ISPs. Selling managed port service to business customers is a significant opportunity for CLECs, because business customers will most likely pay more for each port leased. Business customers can easily be accommodated on the same network designed for the ISP dial-up demand, because many ISPs see traffic peaks during non-business hours – and enrolling business subscribers will load balance day and evening traffic. Additionally, voice-centric CLECs will find dial-up data services easy to sell to their existing base of business voice customers, and the dial-up data service may help improve voice-customer churn rates.

4. The Virtual POP Networking Concept

Under the Virtual POP service offering, the CLEC leases network resources to ISPs interested in outsourcing their networking functions. The concept allows ISPs to concentrate on managing customers, rather than managing networks. The near term Virtual POP service opportunity for CLECs is offering "managed port" service, where the CLEC provides and manages the dial-up modem ports as well as the internet backbone connection(s) for the ISP. This service opportunity can evolve to include VPN, voice over IP, QoS WAN and broadband access service offerings. Another near term opportunity is using the same network infrastructure to offer dial-up and dedicated managed port services to high margin business customers.

The Evolution of ISP Networks to Virtual POPs

ISP networks are continuously improving, evolving toward the Virtual POP network configuration. The figure below shows the major steps in the evolution of ISP networks from "twisted pairs & analog modems" to today's advanced Virtual POP managed port service configurations.

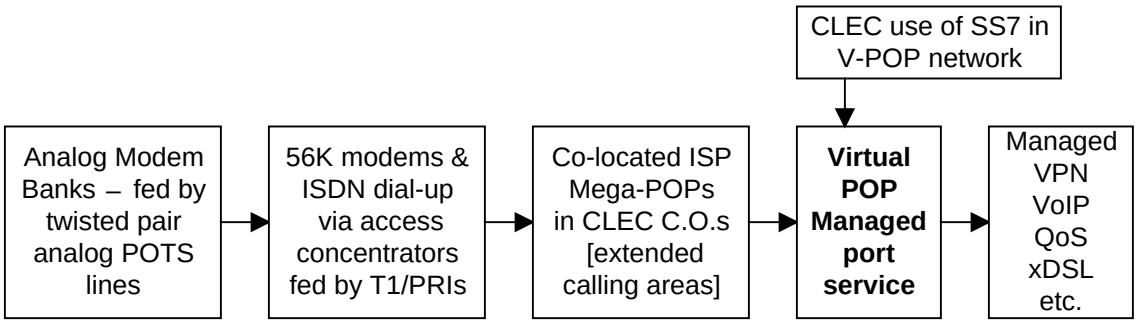

Figure 2 – ISP Network Evolution to the Virtual POP

The Shift From Analog Modems to Access Concentrators

Analog modem banks were widely deployed in the ISP market until the introduction of 56 Kbps modem technology. ISPs are now investing in digital access concentrators connected to digital T1 or PRI access lines at their POPs. This is because 56 Kbps modems require digital access lines in order to achieve connection speeds above 33.6 Kbps. Hence, all ISPs with old-fashioned analog modem banks (fed by analog POTS lines from the LEC), are forced to upgrade their modem technology and invest in new digital T1/PRI circuits to meet customer demands. In short, the ISPs have realized the need to implement advanced access concentrator technology to remain competitive.

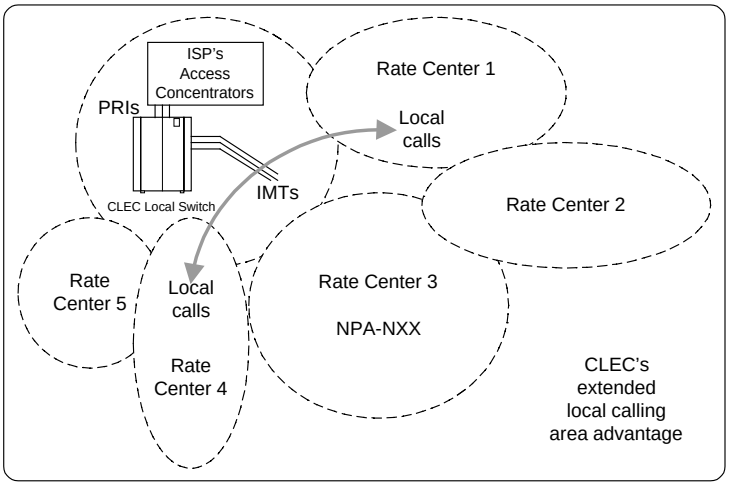

Figure 3 – Co-located ISP Mega-POPs at CLEC Central Offices

Co-located ISP Mega-POPs – The First Virtual POPs

The next step in the evolution is co-location. With co-location, the ISPs can offer local dial-up access to the entire metropolitan area from a single POP co-located at the CLEC central office – fewer POPs same coverage. This idea is the first and simplest version of the Virtual POP concept. With the co-location arrangement, the ISP can realize the following benefits:

- Reliable equipment installation environments
- Easily managed single location
- Reduced communications costs
- Extended local service area from a central location

Other Factors Driving the Full Evolution to Virtual POPs

Virtual POP managed port service is the next natural step in the evolution of ISP networking, and several factors are driving the evolution. One factor is the success of the co-located Mega-POP concept. Another factor is the ISP trend toward managing subscribers rather than managing networks – allowing ISPs and CLECs to focus on their respective core competencies. Equally important is the recent U.S. Telecommunications Act of 1996, which is creating opportunities for CLECs to serve ISPs. And, finally, the advances in carrier class access concentrators with SS7 signaling interfaces have made Virtual POP infrastructures three times more affordable than traditional configurations.

The Typical ISP Networking Functions

Understanding the concept of Virtual POP services requires an understanding of how most ISPs connect to subscribers and to the Internet backbone today. The diagram below shows a typical modern ISP POP, with the ISP owned access concentrator(s) fed by T1/PRI lines from the LEC/PSTN. The access concentrator is able to accommodate a wide variety of network access services on the T1/PRI lines, including analog modems, ISDN, Frame Relay Switched 56 and fractional T1. The typical ISP connects to the Internet NAP or an Internet backbone provider via non-redundant Frame Relay T1 backhaul connections.

Summary of ISP Networking Functions

- Managing Access Concentrators and/or other remote access equipment
- Managing the T1/PRI connectivity to the PSTN
- Managing non-redundant T1 Frame Relay (or faster) connections to the internet backbone

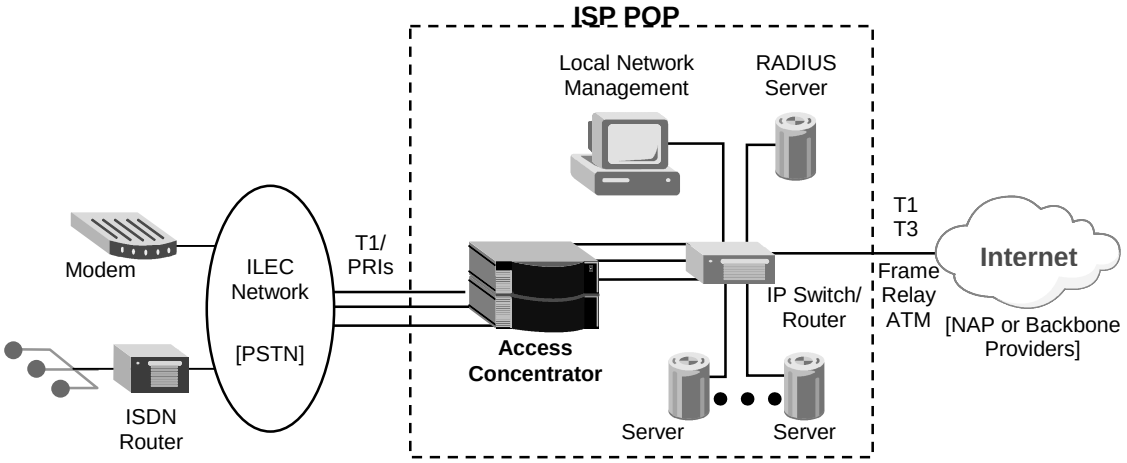

Figure 4 – Today's typical ISP POP includes networking equipment and WAN services for subscriber network access and connection to the Internet backbone, as well as internet servers for e-mail, web site hosting, RADIUS, etc.

The Virtual POP Solution

The Virtual POP network solution relocates the ISP's access concentration and, optionally, their Internet backbone connectivity networking functions to CLEC facilities. Once the managed port service arrangement is implemented, the CLEC owns and manages the access concentrators, the PSTN interfaces, and the high speed router fed connection(s) to the Internet backbone NAP. As part of the service, the CLEC provides the ISP with a high speed IP service connection to their newly re-located network functions. The ISP subscribers can now connect to the ISP with a variety of access services ranging from dial-up modems to dedicated xDSL connections, to native LAN connectivity – all provided by the CLEC.

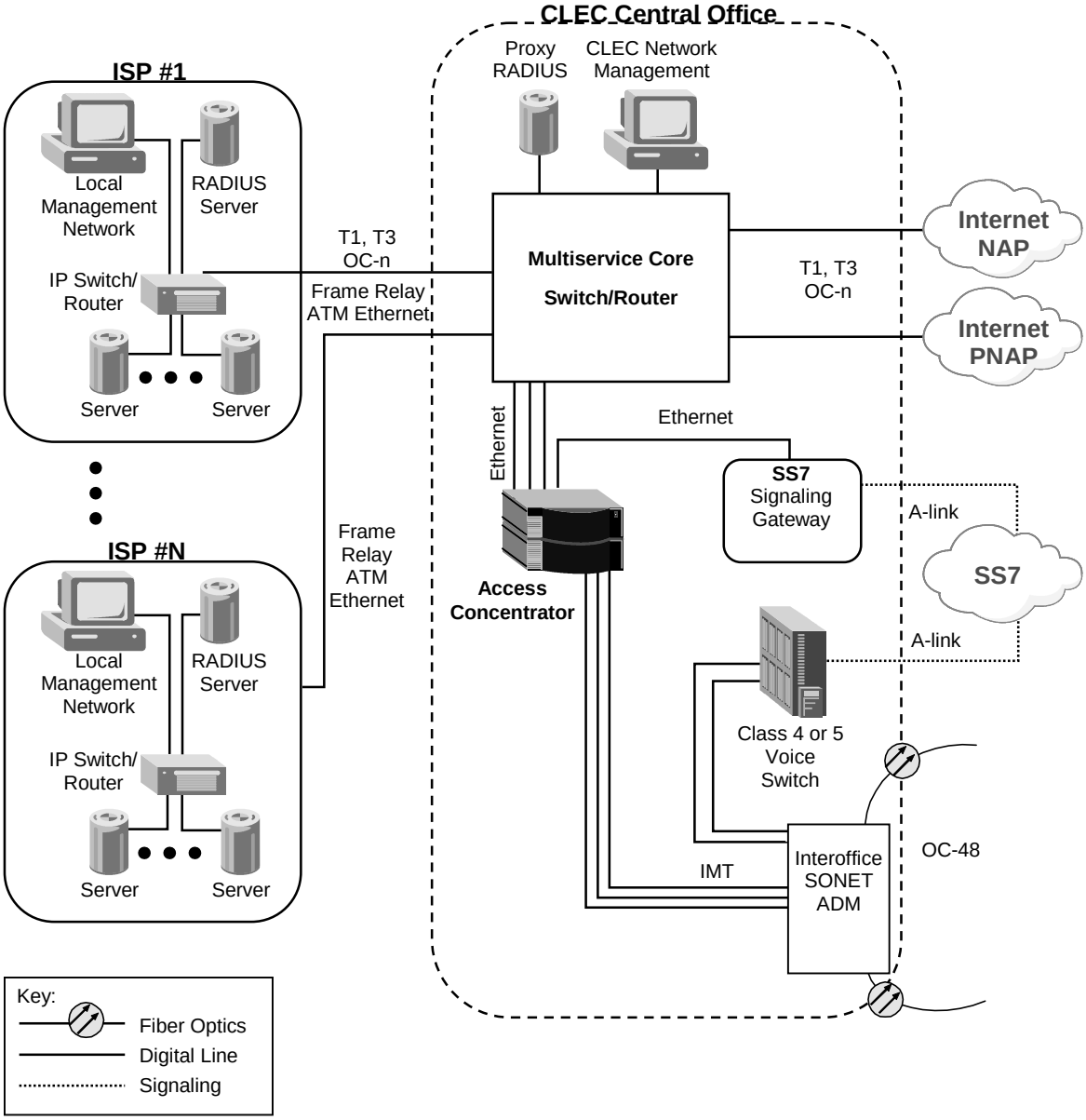

Figure 5 – The CLEC owned "Virtual POP" with its carrier-class access concentration can reach the entire local area, serving the combined subscriber access and Internet backbone connectivity needs of several ISPs.

Assuming the Virtual POP arrangement includes both the “managed port” service and the internet backbone connectivity service, the ISP location will only see subscriber traffic associated with e-mail, RADIUS, web-site hosting, and other value added ISP services. Therefore the ISP needs only a single – less expensive – WAN router (or IP Switch) to interface to the now remote subscriber access concentrators and Internet backbone connection. Note that the Internet backbone connection portion of the traditional ISP configuration, consisting of their high-speed router connections to Internet backbone carriers or Network Access Points, *could* remain the same as before. But this would reduce the economies of scale afforded by Virtual POP service.

Anatomy of an Internet Session

Here is the typical flow of an Internet session in the Virtual POP configuration:

- *The subscriber dials the ISP’s telephone number using an analog modem or ISDN access equipment*
- *The call is directed through the PSTN using standard SS7 signaling, to the access concentrator which has been assigned the ISP’s telephone number(s).*
- *The MAX TNT™ (access switch) terminates the incoming call and establishes a terminal session*
- *Using the proxy RADIUS (Remote Authentication Dial-In User Service) capability of the MAX™, the CLEC’s RADIUS server contacts the ISP’s RADIUS server, which in turn may contact the customer’s RADIUS server, for user authentication, authorization and accounting.*
- *Once authenticated, a PPP session is established between the subscriber and the MAX TNT access switch*
- *The access concentrator(s) are connected to the CLEC packet switching infrastructure which then aggregates and routes all traffic to the appropriate ISP or directly to the Internet backbone.*

At least one number is needed for each ISP. All dial-in traffic to the phone number(s) designated for a certain ISP is directed by SS7 signaling from the PSTN to the CLEC’s central office over interoffice facilities. Since the phone number is designated for the ISP, the call goes directly onto an Inter-Machine trunk connected to one of the CLEC owned access concentrators. The IP network at the CLEC POP is configured to know which traffic belongs to which ISP, and routes all packets appropriately to the Internet backbone or to the ISP-bound IP service links.

Ascend’s MAX TNT Carrier Class Access Concentrator

Ascend’s MAX TNT and other MAX family WAN access switches comprise the majority of deployed dial-up ports worldwide. The MAX TNT WAN access switch supports dial-up and dedicated remote access data services which are the base of the Virtual POP managed port service offering. The MAX TNT is a multiprotocol WAN access switch that enables carriers, ISPs, corporations and Virtual POP service providers to offer a variety of access services such as analog, ISDN, leased T1/E1 and Frame Relay. Because the MAX TNT is the highest-density product in its class, it dramatically reduces central office rack space requirements while driving down the price per port. The MAX TNT is NEBS certified for use in central office environments.

Benefits of Terminating IMTs Directly into MAX TNT Access Switches

The 5000 port CLEC cost model in appendix A assumes that the CLEC connects "Inter-Machine Trunks" (IMTs) directly into their MAX TNT access switch[1] rather than using their class 5 voice switch to interface the MAX TNT via PRI interfaces. This offers major cost benefits to the CLEC, because the CLEC can offload existing data calls from the voice switch and will not require any switch interface modules to support the Virtual POP service offering. Looking at a 10,000 port CLEC model as in the table below, the CLEC's cost of terminating an IMT into the MAX TNT is better than three times less than the cost of traditional termination of PRIs into the MAX TNT via the class 5 voice switch. This cost advantage factor improves significantly as the number of ports increases. Additionally, since data calls do not pass through the CLEC's voice switch at all, the 30 minute average hold-times of ISP dial-up data calls is no longer an issue under this configuration.

Quantified Benefits of Terminating IMTs Directly into the MAX TNT

	Using PRI Switch interfaces to connect to the MAX TNT Access Concentrators		Connecting IMTs directly into the MAX TNT Access Concentrators	
Equipment Required for the 10,000 port CLEC	**Quantity**	**Est. Cost $**	**Quantity**	**Est. Cost $**
PRI Interface module(s) for Class5 switch. Assumes cost of $3750 per PRI interface.	448	$1,680,000	0	$0
DS1-IMT Interface module for Class5 switch @ $1000 per IMT.	448	$448,000	0	$0
Est. Additional Class 5 Switch common equipment (10%)	1	$212,000	0	$0
T1/PRI interfaces on the MAX TNT Access Concentrator @ $1000 per interface.	448	$448,000	448	$448,000
SS7 Signaling Gateway	0	$0	1	$450,000
TOTAL:		**$2,788,000**		**$898,000**

Table 1 – The CLEC's cost of terminating an IMT into the MAX TNT is better than three times less the cost of traditional termination of PRIs into the MAX TNT via the class 5 voice switch.

[1] *The 5000 port CLEC financial model includes all central office equipment required to support the "managed port service" component of Virtual POP service, including the Ascend SS7 Signaling gateway which supports direct termination of Inter-Machine Trunks (IMTs) into the MAX TNT.*

Evolving Virtual POP Service to include High-Speed Internet Access

Business and residential users alike are demanding high speed internet access service, as they remain hungry for bandwidth. Telechoice predicts as many as 500,000 xDSL access lines will be installed by the year 2000. In fact, the more than 50 million dial-up internet users in the US today make excellent candidates for dedicated high speed xDSL or other high speed dedicated access services.

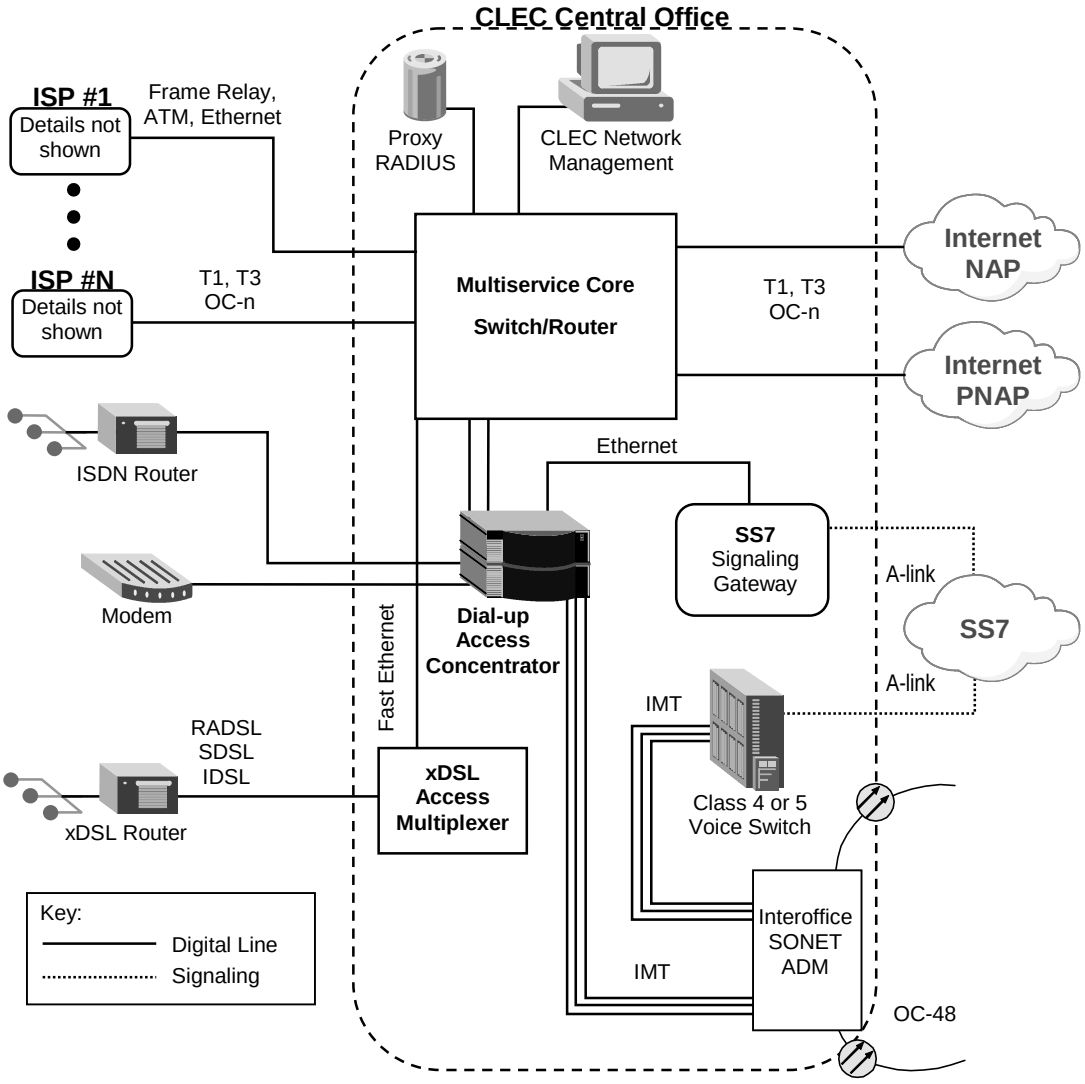

Figure 6 – Adding High-Speed Access Options to the Virtual POP Service Offering

Providing xDSL Access Circuits

By co-locating the xDSL access concentrator in the ILEC central office, the CLEC can provide DSL service using "unbundled" local loops. Installing the xDSL access concentrator in the basement of multi-tenant buildings the CLEC can take advantage of the building's existing telephone wiring to reach subscribers. The most appropriate xDSL access network configuration depends on the CLEC's market, competitive environment, and business strategy.

Providing Dedicated Frame Relay and IP Connectivity Services

For business customers and advanced residential customers, the CLEC can provide dedicated data access services, rather than dial-up. The MAX TNT access concentrators will support Frame Relay services from 56Kbps to T1 speeds under the same basic Virtual POP configuration which supports managed ISDN and modem dial-up port services. The

CLEC can also provided dedicated Frame Relay and IP services directly from their multi-service Core switching infrastructure, depending on the end-users service requirements.

Advantages of Virtual POP Service – Meeting CLEC and ISP Needs

- *Economies of scale make it both cost-effective and profitable because a single physical POP affords local access anywhere in the LATA for any number of ISPs*
- *Offers flexible support for a wide variety of access services, including DSL*
- *Bypasses the CLEC egress switch entirely to add business without need for additional voice switch capacity*
- *Allows both NSPs and ISPs to offer flat-rate or usage-based services*
- *Provides full compatibility with existing Internet access infrastructure, including distributed security & accounting with proxy RADIUS*
- *Can be managed remotely with Ascend's Navis Access™ network management software and Customer Network Management gateway, by both the CLEC and the ISP/Virtual owner.*

5. Selling to ISPs

The secret to success in selling Virtual POP network services to ISPs is emphasizing the many benefits highlighted throughout this chapter. Owing to the daunting challenges and exorbitant costs of Internet subscriber and backbone access in the face of rampant growth and competition, ISPs have been a receptive audience. With both America OnLine (AOL) and the Microsoft Network (MSN) as examples of successful worldwide Internet service providers who neither own nor manage their access ports, the migration has begun. Local and regional ISPs will similarly embrace the opportunity to outsource their network access services.

Nevertheless, resistance to change is an inevitable human trait. So for those ISPs reluctant to convert entirely to Virtual POP service now, consider offering to supplement their existing configuration. In this way, the ISP can maintain a comfort level, while expanding service areas or supporting new WAN services using Virtual POP service.

The Virtual POP Advantage

Under a Virtual POP arrangement, CLECs can literally handle everything, end to end, for one monthly fee. For the ISP, there is only one call to place to add new ports, report a problem or change configuration options. Considering the cost of maintaining in-house expertise and the relentless changes in technology, Virtual POP service is welcome relief to the local or regional ISP. Here is how the service helps address the four major challenges – capital, competition, cost and capacity – facing the local/regional ISP.

Capital – Virtual POP service provides substantial relief to the capital requirements of the ISP. All access equipment and communication services can be bundled by the CLEC and charged as a monthly expense. Local and regional ISPs can use the freed-up capital to expand products and services. The ISP also gets certain tax advantages using monthly expenses, rather than capital depreciation on equipment cost.

Competition – Virtual POP service frees the ISP to focus on those value-added services that differentiate it from the competition. In addition, the Virtual POP arrangement itself can provide a more capable and reliable service to attract and retain Internet subscribers. Finally, Virtual POP service can provide the ISP with immediate, low-cost access to new markets and/or new WAN services.

Costs – Virtual POP service costs the ISP about the same as providing network access directly. But for the same money, the ISP gets a much better solution, making Virtual POP network access the more cost-effective alternative.

- ***Communications –*** Virtual POP services are generally priced on a contractual fixed-cost, per port or per subscriber basis. By using Virtual POP services, ISPs can reduce their overall communication costs by up to 60%. The service also provides a professionally managed redundant access network that improves the overall reliability of the ISP's service.

- ***Personnel –*** Virtual POP service provides a professionally managed access network for the ISP, thus reducing its dependence on expensive in-house support personnel. Advanced access port management software provides the ISP with advanced, easy-to-use management tools to remotely monitor and support the entire network down to an individual subscriber, from a centralized control center, with fewer technicians.

- ***Equipment –*** Virtual POP managed port service eliminates the ISP's need to own and manage access concentrators. It provides a fully redundant access platform that is compatible with the ISP's current service offerings, and allows the ISP to offer new services, such as Virtual Private Networks (VPNs), intranet/extranet consulting, and other enhanced IP services. It provides the latest in communications technology to the ISP without the ISP bearing the cost of a forklift upgrade to their out-dated access platforms.

- ***Facilities –*** Virtual POP service reduces equipment, space, electrical and HVAC requirements. In addition, it eliminates the ISP's co-location charges and the need for facilities in each market it serves. The improved ambient conditions in a CLEC central office could improve overall reliability of the ISP's service.

Capacity – Virtual POP managed port service can virtually eliminate busy signals for each ISP. It provides quick and easy expansion in fast-growing markets. Billing arrangements can be creative, with plans as simple as a guaranteed number of access ports, or as sophisticated as a ready-reserve of access ports to handle peak loads.

The bottom line is this: The Virtual POP managed port service is a more capable, flexible, dependable and affordable alternative for ISPs. Just as few ISPs want to sell modems or develop software, few want to continue bearing responsibility for any aspect of basic network access. Their business is the Internet, not modems or WAN lines or signaling or anything else that fails to differentiate them from their competition. It frees the ISP to focus on the future of their Internet business, managing subscribers rather than networks.

Virtual POP Managed Port Service Benefits for the ISP

- *Increases profits by saving money in several areas: staff, communications, equipment, facilities, training and maintenance*
- *Improves connect success rates with carrier-class capacity and reliability*
- *Enables support for state-of-the-art capabilities, including VPNs, 56K modems, xDSL, VoIP, multicast and more*
- *Expands geographical coverage quickly and easily*
- *Provides "pay per use" incremental expansion of access ports*
- *Eliminates troublesome modem banks*
- *Permits use of a single telephone number for modem and ISDN users*
- *Maintains compatibility with existing Internet infrastructure and CPE*
- *Operates completely transparent to the ISP and the subscriber, including user and domain names, password databases, e-mail addresses, and so on*
- *Allows the ISP to focus on value-added services, rather than basic network access*
- *Enables ISP to obtain a higher level of peering with the PSTN with tandem office interface*
- *Provides the ISP with faster and more reliable connections to internet backbone*

6. The Virtual POP Managed Port Service – Sample Financial Model

Appendix A contains a financial model for Virtual POP managed port service. The "three year 672 port ISP cost model" shows the ISP's 3-year average cost of port ownership to be approximately $100 per month, and this equates to approximately $12 per subscriber, assuming an 8 subscriber per port ratio. The "three year 5000 port CLEC cost model" shows the CLEC cost per port to be less than half that of the ISP, at approximately $46 per port or $4.6 per subscriber. The 672 port ISP model uses cost figures that are most favorable to the ISP. The CLEC Virtual POP model uses cost figures that are somewhat inflated to show worst case scenarios. Nevertheless, the results are quite compelling – as shown in the tables below.

Monthly Cost Parameters	672 Port ISP	5000 Port CLEC
3-Year Avg. Ownership Cost Per Port/Month	$100	$46
3-Year Avg. Cost Per Dial-up Subscriber/Month	$12	$4.6

Table 2 – Comparing CLEC and ISP Costs Per Port

The 5000 port Financial Model for CLEC Virtual POP managed port service shows that the can expect profitability within the first year, and a three year average margin of 68%.

CLEC's Return On Investment – Months	CLEC's 3-Year Average Margin
7 months	68%
Assumptions:	
Number of Subscribers per CLEC Managed Port = 10 sub./port	
Going Rate – ISP Port Lease per Subscriber = $10/sub.	

Table 3 – The 5000 Port CLEC V-POP Financial Model – Highlights

This high level financial analysis shows how economies of scale make Virtual POP network services both cost-effective and profitable for both ISP and CLEC, because the CLEC can provide the managed modem services and internet backbone connectivity to many ISPs, using a shared infrastructure which is better, faster, and cheaper. For simplicity, this analysis lumps the modem port management costs together with Internet backbone connection costs into a total per-subscriber cost which is then easily compared to well known ISP revenues and costs per subscriber.[2]

[2] *Note that some NSPs currently offering the Virtual POP managed port service charge ISPs on a per modem port rather than per-subscriber basis, and they completely separate the Internet backbone connectivity service from the managed port service offering.*

Based on recent studies and the "ISP cost model" in appendix A, an ISP with 672 dial-up ports incurs a cost of $10-13 per subscriber per month, for their dial-up network access and internet backbone connection functions combined.[3] The ISP typically charges $19.95 per month for full Internet service, including internet backbone connection, thus the ISP typically sees a margin of $7-10 per subscriber without subscribing to Virtual POP managed port services. Therefore, we can expect the ISP to pay a conservative $10 per subscriber to the CLEC to realize the benefits of outsourcing their dial-up network access and internet backbone connection functions.

According to the "5000 Port CLEC cost model" in appendix A, the cost to provision Virtual POP managed port services is approximately $46 per port per month, less than half the ISP's cost. Based on queuing theory, larger "groups" of ports can serve more subscribers per port.[4] Accordingly, a single CLEC owned access port can conservatively serve ten ISP subscribers, and the CLEC's cost per subscriber per month is less than $5. This yields a profit of $5-8 per subscriber (or $50-80 per port) per month for the CLEC.

Therefore, an ISP who pays $10 per subscriber per month for Virtual POP managed port service will have costs which are about the same as their traditional method of operation – $10 to $13 per subscriber per month – but with much less risk and hassles, and much more functionality. ISPs owning and managing their access concentrators and their internet backbone connection lack the economies of scale, the reliability, and the subscriber area coverage necessary to compete in the evolving internet services market.

Without Virtual POP managed port services, the ISPs have a two-fold disadvantage related to economies of scale. The first is the higher per-port ownership cost associated with having several smaller POPs. The second is the ISP's limited port-sharing capability, serving fewer subscribers per port, as shown by queuing theory.

The economies of scale afforded by Virtual POP managed port service allow ISPs to achieve an attractive margin from their core business, while providing the CLEC with new network service revenues – focused on their core business as well. The Virtual POP offers a wide variety of access options to the ISPs' customers, including 56k modems, ISDN, switched 56, Frame Relay, and xDSL – helping them remain competitive. It enables ISPs to expand their geographical coverage without major capital expense. It maintains full compatibility with the existing ISP infrastructure, including security and accounting management assisted by the proxy RADIUS function. For the CLEC, it fits well into their voice centric operations environment, focused on the networking side of the ISP business only, and represents a golden opportunity to participate in the explosive data services market place.

[3] *Note that rates may vary substantially in different areas and depend heavily on the distances involved, and local tariffs for T1/PRI connections.*

[4] *Note that for Internet access, a single port can serve any where from 7 to 15 users. This business case uses a ratio of 8 for the ISP POP and 10 for the CLEC V-POP to present a conservative analysis. Queuing theory shows that the larger the POP, the greater the number of subscribers served per port, thus the subscribers per port assumption of 8 for the ISP and 10 for the CLEC is justified by queuing theory.*

Appendix A – Virtual POP Managed Port Service – Financial Analysis

CLEC Virtual POP Managed Port Service - 5000 Port Financial Model

	Annual Operating Numbers			3-Year
	Year 1	Year 2	Year 3	Totals
Total access ports leased	4,700	4,700	4,700	n/a
Managed port revenue per port	$1,200	$1,200	$1,200	$3,600
Optional PNAP connection revenue per port	$0	$0	$0	$0
Total Virtual POP service revenue per port	$1,200	$1,200	$1,200	3,600
Total Virtual POP Service Revenue	$ 5,640,000	$ 5,640,000	$ 5,640,000	$ 16,920,000
Termination Charge Revenue	$ 2,573,250	$ 2,573,250	$ 2,573,250	$ 7,719,750
Total Revenue	**$ 8,213,250**	**$ 8,213,250**	**$ 8,213,250**	**$ 24,639,750**
Equipment Costs	$ 2,917,720			$ 2,917,720
Installation/Maintenance Costs	$ 729,430	$ 437,658	$ 437,658	$ 1,604,746
WAN Costs	$ 60,800	$ 60,000	$ 60,000	$ 180,800
Administration Costs	$ 1,027,542	$ 1,024,000	$ 1,024,000	$ 3,075,542
Total Costs	**$ 4,735,492**	**$ 1,521,658**	**$ 1,521,658**	**$ 7,778,808**
Net Profit/(Loss)	**$ 3,477,758**	**$ 6,691,592**	**$ 6,691,592**	**$ 16,860,942**
Margin	**42%**	**81%**	**81%**	**68%**

Return on Investment (Months): 7

*Termination Charge Calculation	
Number of leased ports	4,700
Number of calls per day per port	10
Total number of calls terminated per day	47,000
Average hold time	30
End-office call termination charge per minute	$0.0050
Daily termination charge revenue	$7,050
Annual Termination Charge Revenues	**$2,573,250**

BASIC REVENUE ASSUMPTIONS (monthly)	
Managed modem revenue per subscriber	$10
PNAP connection revenue per subscriber	$0
ISP subscribers/port ratio	10
Managed port revenue per port	$100
PNAP connection revenue per port	$0
Total Virtual POP service revenue per port	$100
Total Ports leased (out of 5376 Installed)	4,700

NOTES

*The interconnection agreement between LEC and CLEC will specify the per minute charge to be paid by one company to the other for each minute of calls terminated at end-offices, this is the termination charge. This agreement to pay the terminating carrier a per minute fee is also known as "reciprocal compensation."

Appendix A – Continued

Three Year 672 Port ISP COST Model - [Dial-up Ports AND Internet PNAP Access Only]

This spreadsheet shows an ISP's Dial-up Port Total Cost of Owership

total ports= 672

				Initial Cost	Annual Operating Costs Year 1	Year 2	Year 3
Equipment	**Qty**	**Unit Cost**	**Extended**				
Ascend MAX TNT Access Concentrator e/w 672 modem ports							
MAX TNT-2AC Dual Pwr Supply Chassis	3	$ 23,750	$ 71,250				
48 Modem MAX TNT Ckt Pack (56 Kbps	14	$ 24,000	$ 336,000				
Hybrid Access 192 - Ckt Pack	4	$ 9,600	$ 38,400				
100Mb Ethernet Interface	1	$ 7,200	$ 7,200				
ISDN Signaling Software	1	$ 4,000	$ 4,000				
8-port Channelized T1/PRI - Ckt Pack	4	$ 9,200	$ 36,800				
Frame Relay Software	1	$ 4,000	$ 4,000				
4-Port Serial Card - Ckt Pack	1	$ 6,000	$ 6,000				
		List Price total	**$ 503,650**				
		Discounted Price	**$ 327,373**	$ 327,373			
		Based on Discount:	**35%**				
Total Equipment Installation/Maintenance	**Load Factor**	**One Time Charge**	**Annual Charge**				
Installation	10%	$ 32,737		$ 32,737			
Maintenance	15%		$ 49,106		$ 49,106	$ 49,106	$ 49,106
PRI/T1 links to LEC Switch	**Number of Lines**	**Installation Fee**	**Monthly Fees**				
PRI/T1 (including allowed mileage)	28	$ 1,000	$ 1,000	$ 28,000	$ 336,000	$ 336,000	$ 336,000
Avg. additional mileage charge	28	n/a	$ -				
Connection to Internet PNAP	**Number of Lines**	**Installation Fee**	**Monthly Fees**				
Frame Relay 1.544 Mbps	4	$ 3,000	$ 800	$ 12,000	$ 38,400	$ 38,400	$ 38,400
Avg. additional mileage charge	4	n/a	$ -				
Administration	**Number of Net Admins**	**Installation Days**	**Annual Net Admin Costs**				
Installation	1	2	$ 64,000	$ 472.32			
On-going management	3	n/a	$ 64,000		$ 192,000	$ 192,000	$ 192,000
Facilities		**One Time Charge**	**Monthly Fees**				
Space/Power/Etc.		$ 6,000	$ 3,500	$ 6,000.00	$ 42,000	$ 42,000	$ 42,000
		Cost of Ownership SubTotals		**$ 406,582**	**$ 657,506**	**$ 657,506**	**$ 657,506**

Total Three Year Cost of Ownership	**$ 2,379,100**	
Total Three Year Cost of Ownership per Access Port	**$ 3,540**	note:
ISP's 3-year Avg. Monthly Cost per Access Port	**$98**	$2.63 PNAP access included
ISP's 3-Year Avg. Monthly Cost Per Subscriber	**$12.29**	$0.33 PNAP access included

Assumptions	
Ratio Subscribers/Port:	8
Avg. "extra" WAN line mileage:	0
number of 56k modem dial-up ports:	672
number of "ISDN" dial up ports:	0
Net. Admininstrators Per 672 ports:	3

Appendix A – Continued

Three Year 5000 Port CLEC COST Model [Dial-up Ports AND Internet PNAP Access Only]

This spreadsheet shows CLEC's Dial-up Port Total Cost of Ownership

total ports: 5376

Equipment	Qty	Unit Cost	Extended	Initial Cost	Annual Operating Costs Year 1	Year 2	Year 3
Ascend MAX TNT Access Concentrator e/w 5376 modem ports							
MAX TNT-2AC Dual Pwr Supply Chassis	24	$ 23,750	$ 570,000				
48 Modem TNT Ckt Pack (56kbps)	112	$ 24,000	$ 2,688,000				
Hybrid Access 192 - Ckt Pack	24	$ 9,600	$ 230,400				
100Mb Ethernet Interface	8	$ 7,200	$ 57,600				
ISDN Signaling Software	8	$ 4,000	$ 32,000				
8-port Channelized T1/PRI	24	$ 9,200	$ 220,800				
SS7 Interface Software Option (per sys)	8	$ 30,000	$ 240,000				
SS7 Gateway							
SS7 Signaling Gateway (10k-calls)	1	$ 450,000	$ 450,000				
	Total Equipment List Price		**$ 4,488,800**				
	Discounted Price		**$ 2,917,720**	$ 2,917,720			
	discount:		**35%**				
Total Equipment Installation/Maintenance	**Load Factor**	**One Time Charge**	**Annual Charge**				
Installation	10%	$ 291,772		$291,772			
Maintenance	15%		$ 437,658		$ 437,658	$ 437,658	$ 437,658
WAN Services	**Number of Lines**	**Installation Fee**	**Monthly Fees**				
"A-Link" to SS7 Network (56kbps)	4	$1,000	$3,000	$4,000	$12,000	$12,000	$12,000
DS1 - Inter-Machine Trunks - link to LEC	192	$80	$110	$15,360	$21,120	$21,120	$21,120
Avg DS1 - Transport Distance Charge	192	n/a	$0				
45 Mbps Frame Relay PNAP link	1	$800	$5,000	$ 800	$ 60,000	$ 60,000	$ 60,000
Avg. PNAP Link - Trans. Dist. Charge	1	n/a	$0				
Administration	**Number of Net Admins**	**Installation Days**	**Annual Net Admin Costs**				
Installation	1	15	$ 64,000	$ 3,542			
On-going management	16	n/a	$ 64,000		$ 1,024,000	$ 1,024,000	$ 1,024,000
Facilities		**One Time Charge**	**Monthly Fees**				
Space/Power/Etc.		$48,000	$28,000	$ 48,000	$ 336,000	$ 336,000	$ 336,000
		CLEC Cost SubTotals		**$ 3,281,194**	**$ 1,890,778**	**$ 1,890,778**	**$ 1,890,778**

Total Three Year Cost of Ownership	**$ 8,953,528**
Total Three Year Cost of Ownership per Access Port	**$ 1,665**
CLEC's 3-Year Avg. Monthly Cost Per Access Port	**$ 46.26**
CLEC's 3-Year Avg. Monthly Cost Per Subscriber	**$ 4.63**

note:
$0.93 cost of PNAP connect included
$0.09 cost of PNAP connect included

Assumptions

Ratio Subscribers/Port: 10
Avg. DS1 Transport Distance Charge: 0
number of 56k modem dial-up ports: 5376
number of "ISDN" dial up ports: 0
Net. Admin. Per 672 ports: 2

Appendix B: Additional Resources

Related Ascend Documentation and On-line Resources

- Profit Making Tips for ISPs
- MAX TNT Technical Backgrounder
- Offering Managed Port Services to ISPs and Businesses –Technical Backgrounder
- Visit Ascend's web site at http://www.ascend.com/clec

Ascend's "Fast Track" – New Service Introduction Services

Fast Track is a flexible services marketing consulting program that assists service providers in defining and launching unique and competitive broadband data service offerings in areas, such as Frame Relay, ATM and Internet services.

Ascend's "Quick Start" Network Implementation Services

As a response to customer demand for support in the rapid development of a network, the Professional Services Group within Ascend Communications has packaged a set of services known as Quickstart services. These services range from support in defining the Service Provider's service to training the Service Provider's sales force. A key component of the Quickstart program is the Project Manager who coordinates all activities associated with the network deployment. See http://www.ascend.com for more information.

NaviSite – www.navisite.com

For CLECs interested in implementing the Virtual POP Managed Port service offering, NaviSite Inc. offers the GeoDial ISP Plus program, a complete turnkey implementation of the network infrastructure and service implementation with on-going support. NaviSite focuses exclusively on outsourcing solutions for companies that deliver products and services via the Internet. Information on NaviSite's GeoDial ISP Plus wholesale outsourcing program is available on their Web site at http://www.navisite.com or by calling NaviSite's headquarters at (978) 552-3300.

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