NET TO NET TECHNOLOGIES

DSL deployment and the issues of building a DSL access
A How To for Carriers

Affordable and adequate bandwidth for all companies through the deployment of Digital Subscriber Line (DSL) technology is on the horizon. And yet today there are still only a few trained and competent providers able to install, support, and maintain the connection and so ready to take advantage of this market boom. A variety of market conditions have ripened the market for innovative telecomm providers. Increasing deregulation, along with the maturation of DSL technologies is allowing Alternative Operators, Internet Service Providers (ISPS) and Incumbent PTTs to enhance the telephone infrastructure with data capabilities and boost the opportunity to offer value-added services. The emergence of new IP-based technology, voice and data convergence, and packet-based networks has added strong tools to the arsenal of both carriers and providers.

The Needs of the Customers

As users look to the Internet as a key vehicle for business communications in the internet economy, the demands that they make on their networking services are changing. Affordability and uptime are becoming non-negotiable. Flexibility tops the list of customer concerns — users want a range of access speeds and a variable pricing structure from their carrier.

Consumers are also looking for some key traits in their providers: a willingness to explore and invest in emerging technologies (more and more of which are based upon native IP technology); the ability to work with customers both on initial installation and to scale the system to meet evolving needs; and the commitment to achieve quality and reliability that is consistent with the telephone networks that they are used to.

Figure 1 – Growing demand for High Quality Internet Access

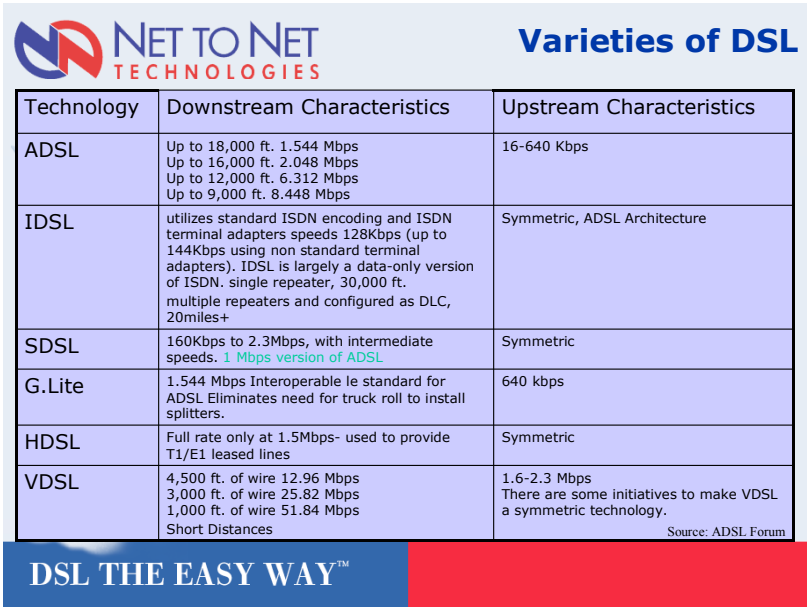
The scope of applications to be supported is also expanding, as customers begin to look at using voice over IP services and video conferencing which demands a

comprehensive and seamless network. These types of applications are just at the beginning of a popularity curve that will continue to grow.

DSL Technologies

One hurdle that carriers must overcome is the creation of the infrastructure, which starts with the selection of network infrastructure equipment or the decision to develop strategic partnerships with DSL wholesalers. The service provider or carrier stands to make more money when utilizing their own infrastructure. However, the task of matching customer demands with an appropriate DSL technology can be daunting. There is no one DSL 'type' that will satisfy all customers. Therefore, it is important to invest in an infrastructure capable of delivering service over many if not all of the available DSL flavors, in order to guarantee that the appropriate service level is available to all potential customers.

DSL leverages ordinary copper telephone lines to create high speed connections; For those homes that are near enough to the central office to receive data rates up to 6.1 mbps (of a theoretical 8.448 mbps) using ADSL, this is excellent solution, enabling continuous transmission of high-bandwidth services such as motion video, audio, and even 3-D effects. However, because the distance limitations of full rate ADSL are limiting, it is more typical that individual connections will provide from 1.544 Mbps to 512 Kbps downstream and about 128 Kbps upstream, which is inadequate for many end users, in particular business end users. The market currently offers a number of different flavors or variations of DSL technology, such as ADSL, G.Lite, SDSL and IDSL, each of which fits a specific customer need, and each of which operates differently depending upon the underlying physical infrastructure. The length of the local loop, the presence (or absence) of fiber-fed remote equipment cabinets, the bandwidth demands of the target customer, and many other factors must be taken into account.



Technology	Downstream Characteristics	Upstream Characteristics
ADSL	Up to 18,000 ft. 1.544 Mbps Up to 16,000 ft. 2.048 Mbps Up to 12,000 ft. 6.312 Mbps Up to 9,000 ft. 8.448 Mbps	16-640 Kbps
IDSL	utilizes standard ISDN encoding and ISDN terminal adapters speeds 128Kbps (up to 144Kbps using non standard terminal adapters). IDSL is largely a data-only version of ISDN. single repeater, 30,000 ft. multiple repeaters and configured as DLC, 20miles+	Symmetric, ADSL Architecture
SDSL	160Kbps to 2.3Mbps, with intermediate speeds. 1 Mbps version of ADSL	Symmetric
G.Lite	1.544 Mbps Interoperable le standard for ADSL Eliminates need for truck roll to install splitters.	640 kbps
HDSL	Full rate only at 1.5Mbps- used to provide T1/E1 leased lines	Symmetric
VDSL	4,500 ft. of wire 12.96 Mbps 3,000 ft. of wire 25.82 Mbps 1,000 ft. of wire 51.84 Mbps Short Distances	1.6-2.3 Mbps There are some initiatives to make VDSL a symmetric technology.

Source: ADSL Forum

Figure 2 – The Various DSL Solutions to meet differing needs

Another major hurdle tied to the infrastructure is developing the capability to service, maintain, and manage the new infrastructure, particularly as the carrier takes on new customers. If the service costs are too intensive to establish a new customer, then the service provider cannot achieve profitability. It is therefore critical that equipment be simple to install and maintain. The simplicity and reliability of the system has to mimic that of the current telephone infrastructure in order for Incumbent Operators to profit from broadband data delivery services. This is especially important when considering that, in many cases, the addition of a new DSL subscriber demands a corresponding equipment configuration. If the service provider or carrier needs to hire and/or train high-tech IT specialists to deploy a single user, the solution is cost prohibitive, whereas a broadband infrastructure that can be managed by non-IT professional voice technicians will prove very successful.

A third hurdle remains: overcoming the common misconception that broadband Internet access (or any Internet access) is a "last-mile" problem. Often, the "Internet access solution" has been a concern shared only between the end user and the ISP. As bandwidth increases, though, as it will with DSL, the solution needs to extend further and further to the heart of the service providers' network, right up to the Internet access point itself. This includes the need to maintain – with the least possible financial impact to the service provider – a network backhaul solution capable of delivering the new local-loop bandwidth to the Internet.

Thinking of DSL service provisioning as a network-wide problem allows the provider to create a solution that is successful for the customer, and still profitable for the service provider. One key element in a data backhaul solution is that it allows individual Points of Presence (POPs) to consolidate the higher bandwidth loads of DSL service areas to a central data center for Internet access. If the new user loads are not accommodated for, the overall service will suffer. Traditional over-subscription ratios, held over from the days of dial-up modems, must be re-investigated by each service provider to accommodate for the always-on characteristics of DSL, as well as the higher overall bandwidth. The data backhaul has traditionally been the most expensive area for bandwidth, since it has traditionally relied upon expensive and complex Frame Relay or ATM backbone networks. As discussed above, the ability to easily add capacity without incurring support costs is critical.

The solution rests in the ability to adapt to specific requirements in a flexible manner. For example, smaller deployments (or smaller geographical regions within a national deployment) may require simplicity and ease of maintenance more than raw amounts of bandwidth. For large POPs, or to interconnect geographic consolidation points where many CO's are aggregated, bandwidth is more important, whereas complexity is not as cost prohibitive (because the lines will typically be set up once and not be changed again). However, because different parts of the network have different requirements, the carrier needs to be able to accommodate these differences, and needs an equipment vendor that can provide this flexibility. This will ultimately save time and expense both in the short- and long- term.

The New Order

All these demands for greater bandwidth have provided an opportunity for a new type of carrier—one that works with Incumbents, Alternative Operators and ISPs to specifically cater to the demands of small and mid-sized businesses for high speed data services.

Alternative Operators have previously built their businesses around traditional telco offerings, making connections from private data networks to leased lines and the Internet. A huge opportunity exists for companies that want to focus on providing comprehensive turnkey solutions that turn small businesses into sophisticated e-businesses. Small to mid-sized users are looking for help right down to the application level, including advanced applications such as e-commerce, always-on Internet access, interactive multimedia programs, telecommuting, groupware, collaboration and distance learning. Service Providers need to partner with these small businesses and create value-added application-oriented services that help these customers create robust and scalable systems that can grow just as rapidly as their businesses might.

The Secret to Success

In order to succeed and stay competitive, a carrier must find ways to leverage existing skill sets and infrastructure against the rise of new IP based Internet services that are in demand. In order to accommodate existing skill sets, the DSL equipment needs to be extremely easy to use, maintain, and troubleshoot. Because of the massive industry shift to a IP-only paradigm, the flawless support and interoperability with IP is a must.

By delivering DSL over a packet-based, pure IP platform, providers are able to provide high-speed, last mile as well as interoffice connectivity using plug 'n' play hardware. Keeping a consistent, packet-based network also avoids mixing multiple technologies in order to provide the DSL transport, since only one technology (IP) is required. Additionally, reducing or eliminating altogether the requirement for complex and expensive ATM or Frame Relay configurations network-wide achieves significant savings.

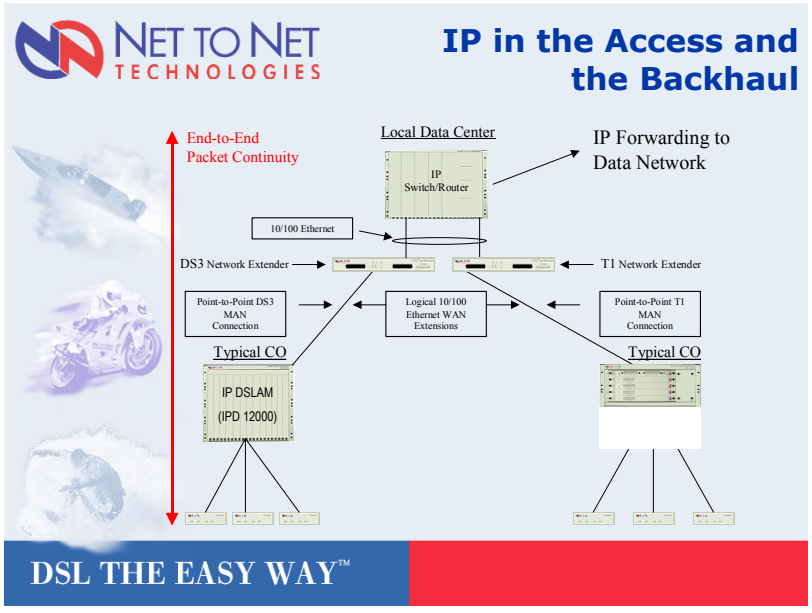


Figure 3 – DSL Solution using IP in the Access and the Backhaul

Service providers should also strive to support and service a variety of DSL technologies, from SDSL to G.Lite to traditional E1... This approach allows the

carrier to carefully match the bandwidth offering with the specific situation (distant limitations, max bandwidth requirements, etc.) of individual customers.

Since DSL uses existing copper wire infrastructure, this technology promises to become more affordable as economies of scale are achieved. The way to compete is to lower the total cost of DSL deployment – both initially when choosing a DSL network equipment vendor, and long term when considering the costs of customer provisioning and maintenance. An end to end, packet-based IP infrastructure allows for the required simplicity and scalability to deploy a DSL network that not only provides consumers and small businesses the bandwidth they need, but also allows the provider to offer these services at competitive prices, while still achieving profitability.

Feedback

If you have any feedback on this paper or require any information on any of the Net to Net Technologies products please contact lhansen@nettonettech.com or visit our European web site at http://www.ntn-emea.com or corporate web site at http://www.nettonettech.com