

Voice Over Digital Subscriber Line Solution

Net to Net's VoDSL solution brings together high-speed data access and multiple voice lines through a single service without the complexity or downfalls of traditional convergence technologies.

Background

In the past, the method of choice for Internet access has been the dial-up modem. The current move is away from 56K dial up to a faster form of access but we still have a long way to go before the era of fiber to the home. This is due partly to the extensive copper networks owned by exchange carriers. For years, vendors have been looking for the perfect solution to send high-speed data long distances over these existing copper infrastructures. Digital Subscriber Line (DSL) technology is rapidly emerging as the system of choice for transporting high-speed data over existing telephone lines to homes and businesses. Today, as we reach the era of convergence, vendors have come across yet another challenge. The current challenge is how to mix voice calls and high-speed data over these same lines.

Initial attempts of transporting data and telecommunications over the same lines include T1 and ISDN. T1 for example, is an established TDM (Time-Division Multiplexing) technology with the ability to combine both voice and data communications. The T1 carrier is still one of the most commonly used digital lines. T1 provides 24 "time slots" at 64Kbps each multiplexed to a single line yielding an overall rate of 1.544 Mbps. Each TDM time slice can carry voice and data channels depending on the needs of the business. T1 provides a dedicated line with guaranteed bandwidth. It is an excellent choice for high end applications, such as large businesses or as an uplink serving many lower speed lines. It is a proven application but can be very costly for the SOHO (Small Office Home Office) network or small businesses to deploy.

ISDN (Integrated Services Digital Network) is a digital service that uses 64 Kbps channels for voice or data and a separate digital channel for signaling. ISDN is a dial-up service that required large deployments of expensive ISDN Central Office switches. This cost is passed along to the consumer in high fees for connection and use. Beyond cost, these ISDN networks were slow evolving and carriers found the equipment complicated to install, configure, and maintain.

These digital technologies are well suited for a few applications, but they fall well short of the requirements of many environments. Voice networks were built with short hold times and multiple 64 Kbps channels. Therefore, these systems are not optimal for data transmission. Conversely, data networks are not well suited for transmitting voice because of transmission delays and unpredictable latency.

The Challenges of Combining Voice & Data

Today, many people require multiple services to their home or small office. A telecommuter will have a phone line for home use, a line exclusively for work, a fax line and another analog line for their 28.8 or 56K modem. If they have multiple computers or printers, they will need a Local Area Network (LAN), and they need WAN access to the outside world. All considered, this means the telecommuter or small business would have several lines coming into the home or office. They may also be paying different providers for all these services.

Service providers have had a difficult time offering a solution that combines multiple voice lines and data services into a single package. With xDSL technology there is hope, but some xDSL solutions are still complicated to install and maintain. In today's competitive environment, companies need their network to be efficient, reliable, and easy to install, maintain and troubleshoot while keeping a relatively low overall cost. With Net to Net Technologies' Voice over Digital Subscriber Line (VoDSL) product offering, the provider can deliver a comprehensive solution that is easy to install, configure, and maintain.

Net to Net's Voice Over DSL Solution

With Net to Net, VoDSL the Easy Way™ is becoming the method of choice to bring the service provider to the next level. A solution is now available to bring together high-speed data access and multiple voice lines through a single service without the complexity or downfalls of traditional convergence technologies. Net to Net has always been known for our DSL the Easy Way™ technology. Now, with the same product design philosophy, Net to Net has taken the next step. Reliability, ease of use, and plug & play has been incorporated into VoDSL the Easy Way™ - bringing a complete VoDSL solution to the DSLAM without any additional equipment or upgrades.

Net to Net VoDSL is a feature rich platform supporting AutoIP™ architecture and IPacket™ technology. VoDSL the Easy Way™ is a simplified voice solution effortlessly integrating with the provider's existing connection to the PSTN (Public Switched Telephone Network). Delivering voice as a traditional T1 voice trunk in the Central Office allows the provider to work with the existing voice switches and no complicated gateway device is required.

Designed for Net To Net's IPD4000 and IPD12000 native IP DSLAMs (DSL Access Multiplexer), Net To Net will introduce the SIM2000V-12 and the SIM2000V-24. These are 12 and 24 port SDSL access multiplexer modules with integrated voice support and inverse multiplexing capabilities. These modules allow the integration of data and multiple voice lines over the same copper pair.

The end user will use the SIA20xx-S as their Customer Premise Equipment (CPE). This is a LAN to SDSL subscriber unit with the addition of up to four analog voice lines.

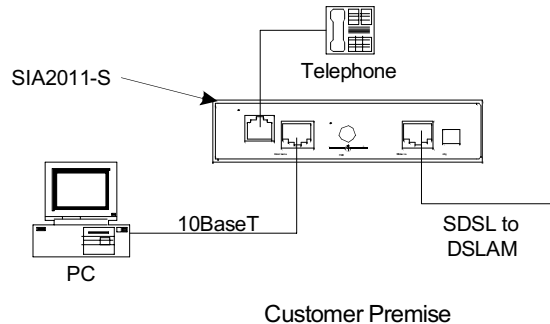
At the same time, Net to Net offers the highest speed DSL available by inverse multiplexing or loop bonding up to four 2.3Mbps SDSL lines for an amazing 9.2Mbps of symmetrical bandwidth. With this solution, voice prioritization and Quality of Service (QoS) is guaranteed. There is no additional delay or loss of voice quality due to Net to Net's dynamic bandwidth allocation that guarantees bandwidth on demand for each and every voice call. Unlike TDM technology, the reserved bandwidth will be reallocated for data when the channel is no longer needed.

Functionality

Customer Premise Equipment

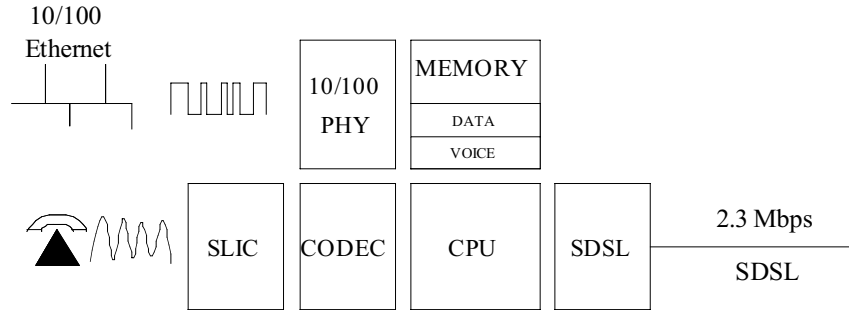
There is no need for configuration at the customer premise. The CPE is completely plug & play. The end user only has to plug it in and the connection will be made automatically. The end user is presented with up to four RJ11 ports that will support any analog connection. The CPE can support four active voice connections. For Internet or data services, the CPE hosts an RJ45 Ethernet connection.

The smaller configuration is the SIA2011-S. This SIA2011-S is a CPE with an SDSL connection to the DSLAM, one voice line and one 10BaseT interface for data. The SDSL line supports nine speed settings from 144Kbps to 2.3Mbps set at the DSLAM.



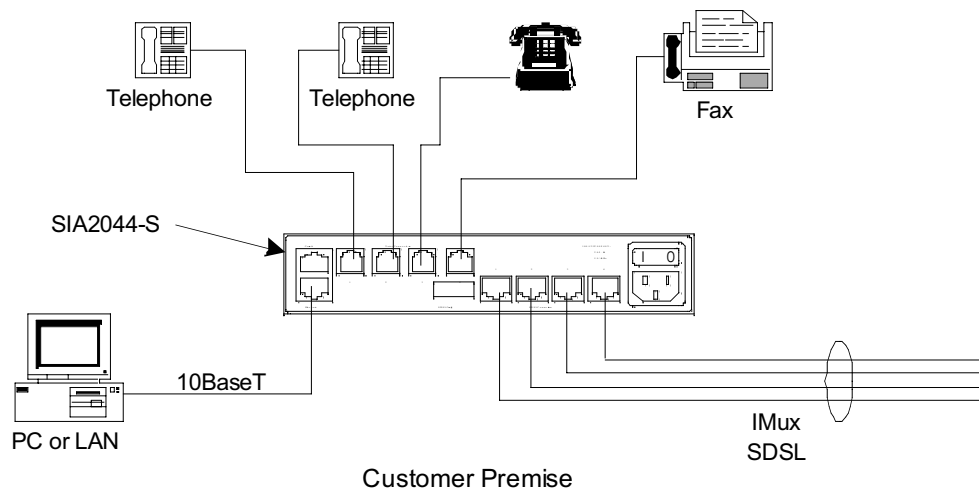
When the telephone or voice connection is “on hook” the CPE will work like Net to Net's traditional SDSL subscriber unit. When the CPE receives Ethernet frames, a physical layer conversion is done. The Ethernet frames are recoded to CAP or 2B1Q (depending on the model) and transmitted across the SDSL link at a speed set by the DSLAM. No cell or frame conversion is necessary as this is a fully IP/Ethernet solution. The built in SLIC detects when the telephone is “off hook.” When off hook, any voice traffic is given priority through a dynamic TDM concept. A 64Kbps channel is allocated for voice only traffic. The remaining bandwidth will be used for data traffic. This guarantees voice quality while preserving maximum data bandwidth for the customer. The CPE uses a built in CODEC (coder/decoder), to convert the analog voice signal to a digital stream. This voice packet will be injected into the data stream at predetermined time intervals controlled by the TDM algorithm. The on board memory will buffer data traffic to allow for voice traffic prioritization.

Refer to the diagram below for a logical representation of the CPE.



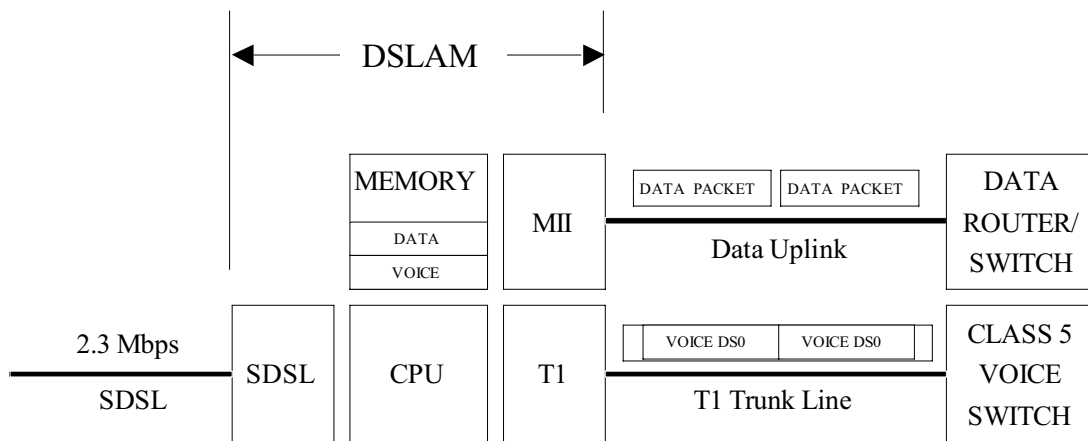
If you take a look back to the previous section, an example was given about the telecommuter or a small business. In this case, more than one analog line is needed, several are needed in fact. If a subscriber needs more than one voice line there are more CPE options available. The SIA1044-S provides the end user with up to four analog connections and the 10BaseT LAN connection. Other models will allow the provider to activate up to four SDSL lines to the CPE. This capability, when combined with Net To Net’s inverse multiplexing (IMux) feature allows the provider to double, triple or quadruple the SDSL bandwidth (up to 9.2 Mbps) provided to the subscriber. In this solution, the CPE hosts a SLIC for each analog connection and two dual CODECs. When any connection is “off hook” the SIA2044-S will reserve 64Kbps of bandwidth for EACH active call. This is called “**dynamic bandwidth management.**” When a call is completed and the phone is “on hook” the reserved bandwidth is now available for data.

The impact on data throughput created by adding this voice support is minimal. For example, given a scenario where a service provider is supplying a 2.3Mbps SDSL connection and four analog voice lines. If the end user is using the telephone, the CPE will reserve 64Kbps for the call and now the user has 2.236Mbps available on the local loop. If all voice lines were “off hook” 2.044Mbps would be available. 64Kbps is all that is needed for a voice call and this bandwidth is reserved when the phone is “off hook” therefore there is no quality loss or additional voice latency during any telephone call.



DSL Access Multiplexer

Net to Net Technologies' SDSL VoDSL module for the IPD12000 or IPD4000 handles combined voice and data traffic in such a way that makes it very easy for the service provider to configure and maintain. Simply stated, the module will split the voice and data streams at the board. The data will be forwarded to the uplink module via a backplane connection while the voice traffic will be forwarded to a T1 port on the front of the module. The diagram below is a logical representation of VoDSL within the DSLAM. The SDSL port on the DSLAM receives a combined data and voice stream. The DSLAM will separate the voice from the data stream based on the TDM algorithm. The Media Independent Interface (MII) will forward the data to the uplink port via the backplane and uplink module. The voice is directed to a T1 port on the front of the module and forwarded to a telephone switch via multiple T1 trunk lines.

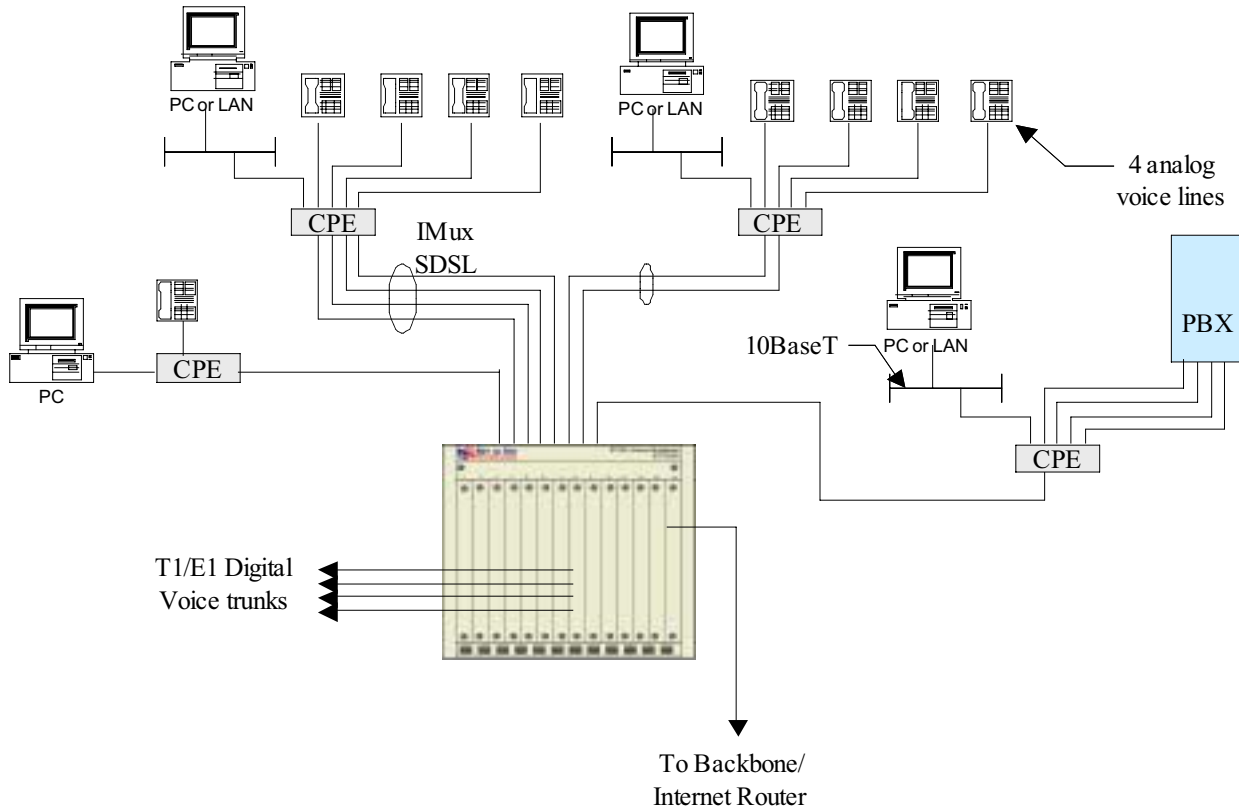


The SIM2000V-24 is a 24 port SDSL module for the IPD12000/IPD4000 with inverse multiplexing and integrated voice services. The module supports SDSL connections via an RJ21 port on the DSLAM and has four T1 ports for voice trunks. The T1 ports supports Channel Associated Signaling (CAS).

The following diagram illustrates a VoDSL deployment using Net to Net Technologies' VoDSL the Easy Way™ solution. The two CPEs at the top of the diagram depict a SOHO environment with four voice lines and a LAN connection. These offices probably need more bandwidth than typical SDSL can provide so they have selected an IMux solution which doubles and quadruples the bandwidth until the desired speed is achieved. The CPE on the left depicts a home user with one voice line and an Internet connection directly on their computer. The CPE on the right is connected to a LAN and a PBX or key system via four analog lines. All the CPEs are connected to the DSLAM in the CO via SDSL or multiple SDSL lines. The DSLAM splits the voice and data.

The data gets sent to the Internet router while the voice gets sent to the PSTN via T1 digital voice trunks.

Net to Net Technologies: Voice Over Digital Subscriber Line



Integrating Voice and Data services increases the profit-making potential of any ILEC or CLEC by allowing a single copper pair to return two distinct sources of revenue. In addition to infrastructure savings, Net to Net's VoDSL solution reduces the ongoing support costs typically associated with deploying VoDSL, allowing service providers to increase revenues even further. Net to Net Technologies offers VoDSL the Easy Way™ — the simplest method of deploying voice and data services over DSL technology.