ADSL AND VDSL: An improved channel system

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Abstract- **As the new communication technology is developing day by day, so there are different types of modem used in present world to connect through internet. This research paper will examine the different types of modems and which modem is best. This paper provides an overview of the newly emerging Asymmetrical Digital Subscriber Line (ADSL) and very high bit-rate digital subscriber line (VDSL). ADSL increases the amount of data sent over existing copper telephone lines whereas VDSL delivers data through a pair of copper lines twisted together to make a single line. A brief overview of ADSL and VDSL technology is provided, describing important technology considerations, including noise impairments, spectral compatibility and "data over voice" design challenges.**

I. INTRODUCTION

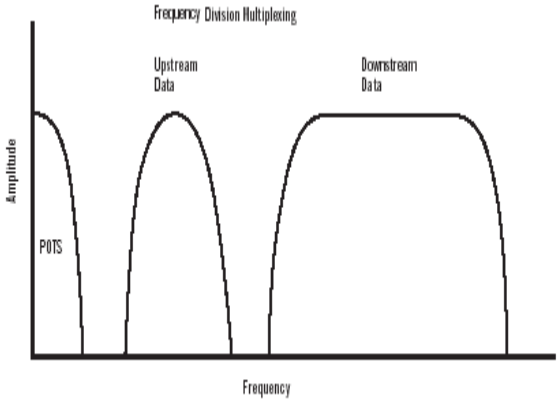
Digital subscriber line (DSL; originally digital subscriber loop) is a family of technologies that provide internet access by transmitting digital data using a local telephone network which uses the Public switched telephone network. In telecommunications marketing, the term DSL is widely understood to mean asymmetric digital subscriber line (ADSL), the most commonly installed DSL technology. DSL service is delivered simultaneously with wired telephone service on the same telephone line. This is possible because DSL uses higher frequency bands for data. On the customer premises, a DSL filter on each non-DSL outlet blocks any high frequency interference, to enable simultaneous use of the voice and DSL services.

The bit rate of consumer DSL services typically ranges from 256kbit/s to over 100 M bit/s in the direction to the customer (downstream), depending on DSL technology, line conditions, and service-level implementation. Bit rates of 1 G bit/s have been reached in trials. In ADSL, the data throughput in the upstream direction, (the direction to the service provider) is lower, hence the designation of asymmetric service. The two main DSL technologies to be discussed in this are the Asymmetric Digital Subscriber Line (ADSL) and Very high-speed Digital Subscriber Line (VDSL) systems.

II. ADSL

The long form of ADSL is asymmetrical DSL. Similar to 56k modem, it provides higher bit rate in the downstream (from internet to the user) as compared to the bit rate in the upstream direction (from user to internet). This is why it is called as asymmetrical. ADSL divides the bandwidth of a twisted pair cable of 1 MHz into 3 bands. The first band is between 0 and 25 KHz. It is used for regular telephone (plain old telephone sets-POTS). This services uses only 4 KHz of this band the rest is used as guard band to separate the voice channel from the data channels. The second band is from 50 KHz to 200KHz. It is used for upstream communication. The third band is from 250 KHz to 1MHz. It is used for downstream communication. There are both technical and marketing reasons why ADSL is in many places the most common type offered to home users. On the technical side, there is likely to be more crosstalk from other circuits at the DSLAM end (where the wires from many local loops are close to each other) than at the customer premises. Thus the upload signal is weakest at the noisiest part of the local loop, while the download signal is strongest at the noisiest part of the local loop. It therefore makes technical sense to have the DSLAM transmit at a higher bit rate than does the modem on the customer end. Since the typical home user in fact does prefer a higher download speed, the telephone companies chose to make a virtue out of necessity, hence ADSL. The

marketing reasons for an asymmetric connection are that, firstly, most uses of internet traffic will require less data to be uploaded than downloaded. For example, in normal web browsing a user will visit a number of web sites and will need to download the data that comprises the web pages from the site, images, text, sound files etc. but they will only upload a small amount of data, as the only uploaded data is that used for the purpose of verifying the receipt of the downloaded data or any data inputted by the user into forms etc. This provides a justification for internet service providers to offer a more expensive service aimed at commercial users who host websites, and who therefore need a service which allows for as much data to be uploaded as downloaded. File sharing applications are an obvious exception to this situation. Secondly internet service providers, seeking to avoid overloading of their backbone connections, have traditionally tried to limit uses such as file sharing which generate a lot of uploads.

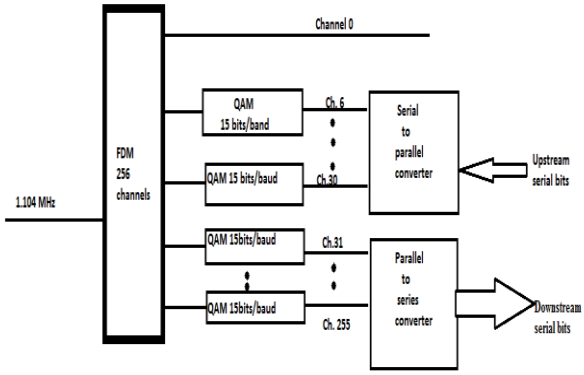


Bands for ADSL

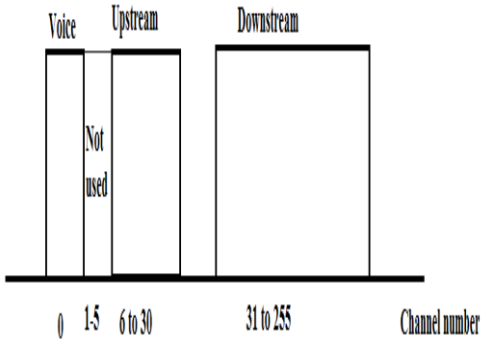
III. DISCRETE MULTITONE TECHNIQUES (DMT)

It is standard modulation technique for ADSL. It combines QAM and FDM. The available bandwidth of 1.1 MHz is divided into 256 channels. However this is not a rule. the division may change system to system.

FDM has 156 of channel. Channel 0 is reserved for the voice communication. Channels 1 to 5 are called as idle channels since they are not used. These channels create a gap between the voice and data channels. Channels 6 to 30 (25 channels) are used for the upstream data transfer and control. 24 channels are of data transfer and one channel for control. For 24 channels (4 KHz each) with QAM modulation the bandwidth is 24 * 4 KHz * 15 or 1.44 Mbps in the



upstream. The channels 31 to 255 are allowed for downstream data transfer and control. Out of 255 channels, one is reserved for control and remaining 224 are reserved for data. The downstream bit rate is 224 * 4 KHz * 15 = 13.4 Mbps.



Bandwidth division in ADSL

Actual bit rate:

The actual bit rates are normally as follow:

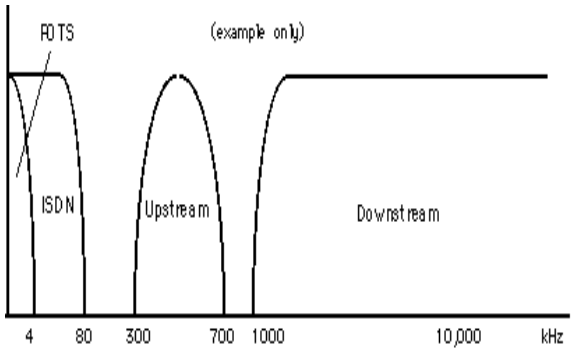
Upstream: 64 Kbps to 1 Mbps.

Downstream: 500 Kbps to 8 Mbps.

IV. VDSL

Very-high-bit-rate digital subscriber line (VDSL or VHDSL) is a digital subscriber line (DSL) technology providing data transmission faster than ADSL over a single flat untwisted or twisted pair of copper wires (up to 52 M bit/s downstream and 16 M bit/s upstream),and on coaxial cable (up to 85 M bit/s down- and upstream) using the frequency band from 25 kHz to 12 M Hz. These rates mean that VDSL is capable of supporting applications such as high-definition television, as well as telephone services (voice over IP) and general Internet access, over a single connection. VDSL is deployed over existing wiring used for analog telephone service and lower-speed DSL connections. The basic features of VDSL system are flexible scalability for symmetric and asymmetric transmission, single duplex transmission, field programmable bit rates depending on noise environment and cable length & parallel operation of Plain Old Telephone Service (POTS) and / or ISDN.

To reach a large number of customers (subscribes) with the existing copper wire twisted pair distribution network the VDSL system should use only one twisted pair and co-exist with POTS and ISDN. A VDSL connection uses up to seven frequency bands, so one can allocate the data rate between upstream and downstream differently depending on the service offering and spectrum regulations. First generation VDSL standard specified both quadrature amplitude modulation (QAM) and discrete multi-tone modulation (DMT).



VDSL frequency spectrum

V. COMPARISON OF ADSL AND VDSL

S.no	Parameter	ADSL	VDSL
1.	Mode	**Asymmetric**	**Asymmetric**
2.	Signaling	**Analog**	**Analog**
3.	Frequency	**1 to 5 MHz**	**10 MHz**
4.	Copper pairs	**1**	**1**
5.	Bits/sec	**1.5 to 9 Mbps downstream 16 to 640 Kbps upstream**	**13to52Mbps downstream. 1.5 to2.3 Mbps upstream**
6.	**Bits/cycle**	**Variable**	**variable**

VI. CONCLUSION

We, in this paper, analyzed the ADSL and VDSL subscriber, after analysis, it can be concluded that A new model for telephone lines which combines the frequency response of the line with the noise model, and which allows for an arbitrary point of ingress for impulse noise events, has provided a more realistic basis for development and optimization of ADSL and VDSL systems.

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