Comparison of Internet Access Options

By

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Abstract: Which of the many Internet Access options are best? If Telecom service is critical to an organization's mission, cost may not be the primary consideration. This presentation will review reliability, bandwidth consistency, and quality of DSL, Cable, FiOS, Satellite, T1, DS3, OC3, OCx, Fast Ethernet, GIG-E and varieties of Fixed Wireless connections. It will address such questions as:
1. Is cable really faster that DSL?
2. How does VoIP fare over the different services?
3. Is FiOS a replacement for T1 service? Isn't it faster?
4. What is an Integrated T1?
5. What is EoC and EoD?
Although some of the discussion, especially the first part, will be useful to an individual, the later parts of the presentation are mainly applicable only to organizations for which a Telecom connection is critical to their mission.

Bio: Joe Budelis has performed IT or Business consulting with such diverse assignments as Senior Financial Analyst, SAS Data Analyst, Business InfraStructure Manager and Data Base Administrator. Currently, Joe assists businesses to find cost-effective Telecommunications solutions; primarily consulting on, and selling, such services as T1, DS3, Ethernet, and OC3 voice and data, MPLS, SIP, VoIP phone service and conferencing services. For more information see his blog at http://persimmontelecom.blogspot.com/. Joe has a PhD from Harvard in Decision and Control.

Contents

I. What different Internet Access Options are available to you?

Many people are surprised at how many Internet Access options are available. Many are also surprised how many carriers offer certain services to a given location. We have what is probably the world's foremost software for determining what options are available at any given building. When I run a quote to determine T1 service availability, it's not unusual for the automated system to give well over 100 options. Admittedly, some of these are very similar; many services will have availability on a 1, 2 and 3 year contract with the main, if not the only, difference(s) being the price. Nevertheless, there are still a lot of options for most Telecom services at each building. These options vary in pricing and in which features and characteristics are included.

However, the next surprise that many people have is that the building next door might have different options than your building. Why? There are thousands of telephone Central Offices (COs) throughout the country. Most buildings are connected to one and only one CO. For diversity, some buildings may have connections to two or more COs but this is not the norm. The facilities available to provide the various services vary amongst COs. And, pricing for the same service can be different between COs. Additionally; some services are dependent on the length of the wiring between the CO and the customer premises.

Dial-Up availability is mainly dependent on whether there is an access number to the service which is local to you since otherwise it will be a toll call to connect to the service. DSL availability, assuming a carrier has DSL facilities in your CO, is determined by the length and quality of the wiring from the CO. Incidentally, there are different types of DSL: ADSL, SDSL, and IDSL are the main types. Each type has different distance characteristics which can vary depending on the carrier's implementation. It's not unusual for someone to tell me DSL is not available at their building cause Verizon told them so. Verizon will tell you that they can not provide DSL service; that doesn't mean that another carrier cannot do so even though some things will prevent anyone from providing DSL.

Cable, FiOS and traditional Ethernet availabilities depend on whether cable or fiber has been connected to your building. Often if it is not connected to your building but is already near your building, the provider will connect your building. However, the provider may charge you for making this connection and the charge could be very substantial.

FiOS is Verizon's name for a DSL-like service that is delivered over fiber that thus allows much higher bandwidths than DSL. In other parts of the country, other providers offer similar fiber optic service using different names.

Satellite service can be provided to any building for which an antenna can be installed that has a satisfactory view of the sky. The usual reason that satellite is not available is tree or high-rise building interference with line of sight to the satellite.

T1 service can be provided to any building that has a couple available copper pairs connecting the building to a CO which would include most buildings in the country. For buildings very distant from a CO, the cost can be much higher than for buildings in a metropolitan area. Similarly, DS3 and OCx service can be provided to any building that has the appropriate wiring. However, either fiber or many more copper pairs are needed to provide these services.

Fixed Wireless availability depends on the availability of nearby antennas. As mentioned above, availability of traditional Ethernet service is dependent on distance and the existence of Ethernet wiring. Many carriers offer equivalent Ethernet service via EoC (Ethernet over Copper) and similar services.

II. Is bandwidth (or speed) the most important characteristic of a connection?

Why is it that an office that had difficulty running on a 6 Mbps x 2 Mbps cable connection can run satisfactory on a 3 Mbps x 768 Kbps DSL connection and even better on a 1.5 Mbps x 1/5 Mbps connection? Do not misunderstand – this is not always the case, however, it does happen. Most cable offerings and most DSL offerings include the words "up to". In other words, you might experience the stated speeds, but you might not. Or, more commonly, you might see the stated speeds when none of your neighbors are using their connections. This is because the design of cable systems is that you are sharing the Internet connection directly with your neighbors. DSL speed is usually a little more consistent because, although you are sharing the connection from the CO into the internet, you are not sharing the connection to the CO. Some DSL providers engineer their facilities so that there is sufficient capacity between the CO and the internet that you rarely see any significant degradation in DSL bandwidth.

In T1, DS3, OCx and Ethernet connections and some Fixed Wireless connections, you have dedicated bandwidth. In other words, you are not sharing it with your neighbors or anyone. With these services, bandwidth variation of the provided circuit is minimal. However, beware that once in a while we hear of organizations that claim to be selling a service that is not what they say. For example, if someone offers you T1 service for less than $150 per month, it most likely is not true T1 service cause the cost to provide the service is higher than that. I was going to write $200, however, even though I haven't seen true T1 service at less than $200 per month, it is now available in some locations at less than $300. A decade ago, many T1 circuits cost well over $1,000, most have now come down significantly. In the last couple years, some carriers have raised their T1 pricing so perhaps the bottom has been reached. If not, then there may be certain locations (for example, within a building that houses a CO) that some day will see T1 pricing around $200.

I use Fixed Wireless to describe two types of Internet Access: Internet Access using a wall mounted, window mounted, or roof mounted antenna to connect to cell phone towers; and Internet Access via a microwave connection. The bandwidth of the cell phone system has characteristics similar to that available on DSL while the bandwidth of

the microwave system is closer to T1, bonded T1, DS3 and Ethernet characteristics except that some microwave systems have high latency, jitter or packet loss.

The bottom line is that you can not just compare bandwidths across the different access methods unless you are comparing T1, DS3, OC3, Ethernet and above. To determine what bandwidth you have available on your connection, see the last paragraph in [T1 Service](#).

III.   How important is reliability and what does reliability really mean?

Most of you have heard that T1 service is more reliable than DSL and cable. What does this really mean? Well, although many DSL providers and cable providers do not provide SLAs (Service Level Agreements), T1 providers do. The bottom line is that technically T1 service is designed to be more reliable than DSL service. Furthermore, if T1 service does fail, FCC rules require that a carrier give priority to restoring T1 service.

However, the reliability of any given service varies greatly from location to location. I know of situations where DSL or cable service has been extremely reliable for a period of years. On the other hand, there are locations where DSL service goes down about once a day for a period of hours and the carrier has not fixed this problem even though they have devoted resources to improving the service. In other locations, there are regular cable outages.

One hears stories following natural disasters like hurricanes and earthquakes in which T1 service is perhaps restored to most customers within a couple days while DSL service might not be restored for weeks. With smaller scale outages, T1 service is typically restored in much shorter periods of time while DSL and cable service may or might not be restored in as short a period of time.

The bottom line is that if a business is critically dependent on Internet Access, it is usually worth the extra cost of T1 service over DSL, cable or FiOS. Many organizations justify going to T1 service after estimating the monetary loss to the business if their Internet Access is down for a day or a significant portion of a day and comparing that loss to the differential cost of the more reliable service.

IV.   Is bandwidth consistency important?

If large files are being transmitted, like x-rays, architectural drawings, music or video files, than the amount of bandwidth required per person can be huge. There are situations where a T1 is not sufficient for one person.

However, there are also offices containing 20 to 100 people where a 1.5 x 1.5 Mbps T1 provides satisfactory service. In many offices, everyone in the office is not accessing the Internet at the same time. Furthermore, if people are simply browsing the Internet and sending and receiving Emails without a lot of large files attached, this type of ratio of

people to bandwidth can work well. However, often this type of ratio can not be satisfactory supported on cable and perhaps not on DSL, cause at the time when most people in the office are using the Internet, many neighbors are doing so also and are driving the available bandwidth down significantly.

Once you understand the vastly differing bandwidth requirements, you can then have a feel for what the impact will be if the bandwidth being provided varies widely. Always ask a potential provider whether the speeds that they specify are "up to" speeds or are dedicated speeds. In many locations, the busiest time for Internet access is in the 2 to 3 PM range. If a slowdown in the speed of Email access, transaction processing, the loading of web pages, and the transfer of files is not a big deal to you or your business, than it might not matter if you use cable whose speed is noticeably slower during certain periods. An example of where bandwidth reliability does not justify a move from cable or DSL to T1 service would be someone who only uses the Internet to send and receive Email using a desktop Email client without any critical need that the Email be sent or received immediately.

V.   What about latency, packet loss and jitter?

For Email and for web browsing, latency, jitter and packet loss on a circuit has no perceptible effect. For Internet Telephony, these factors determine voice quality. Latency refers to the time it takes a packet of data to travel across your connection. If there are delays, this adversely affects voice quality if you are using VoIP. Packet jitter in computer networks is the situation where latency varies over time resulting in some packets arriving out of sequence. This is not a problem for many applications like Email and web browsing but again lowers the quality of an Internet telephony call. Problems caused by packet loss can be reduced or eliminated using packet recovery techniques however; these typically increase both latency and jitter. VoIP, online gaming and videoconferencing are examples of applications that are adversely affected by packet loss. Latency, packet loss and jitter vary on different Internet access methods. Unless the provider issues a SLA that covers these Quality of Service (QoS) issues, you may have no guarantee as to how good they will be. However, T1, DS3, OCx and Ethernet services usually are pretty good in these areas. Usually if you obtain VoIP service from the same provider as the one who provides your access method, the provider will take responsibility for QoS and CoS (Class of service) which will allow the provider to give better service to your voice packets than to your other data packets.