A commonly misunderstood element of using a mobile satellite antenna system is simply the bandwidth segment. Often comments seem to come from two thought groups — its too expensive or simply too cheap. The questions below should help in defining a solution that is right for each user and finding the middle ground of performance and cost.

**Question:** I’m new to satellite systems and I don’t know much about bandwidth... How do I get started?

**Answer:** Make a list and define what you are going to do:

- Typically, how many days per month is this system going to be used?
- How many computer users will be on-line concurrently?
- Will they be ‘surfing’ and doing general internet access or will there be a lot of large files being transferred?
- Are you going to have requirements for Voice Over IP (VoIP)?
- How many users will be using the VoIP phones concurrently?
- What is the bandwidth requirement in Kbps of each phone type you are using?
- Will there be video teleconferencing? If so, what is the recommended data transfer rate of the equipment? (In Kbps)
- How often will the video teleconferencing be used?
- Will there be streaming video? At what resolution and frame rate?
- What elements above are planned for being used concurrently?
- Geographically, where is the antenna going to be deployed?
- Will the applications be rural?
- What type of vehicle will the antenna be mounted on?
- Height of vehicle from road to roof line (not including air conditioners) is needed.

From here, TracStar will help you decide the critical tasking elements to prioritize requirements of the satellite service. This step will help maximize performance and minimize the monthly recurring costs as the solution is fine tuned to a ‘need’ versus ‘want’ priority list.

**Question:** What do the numbers mean? 128/512? 256/1000?

**Answer:** Bandwidth is typically stated in kilo-bits-per-second (a kilo is 1000). Following the way TracStar states the numbers, the first number is the In-Bound to the hub—which is your Out-bound or transmit from the vehicle. The second, and typically larger number, is the Out-bound of the hub and the In-bound or receive in your vehicle. 128/512 means your vehicle satellite communication has a 128Kbps transmit and 512Kbps receive average speed.

**Question:** I’ve been looking at pricing and bandwidth seems expensive. Why?

**Answer:** Bandwidth is a limited supply product on each satellite in orbit. As the satellites are in limited supply too, market forces have a hard time converging into a solution that satisfies the economic models users want to see.

It’s not cable TV. To build a satellite may easily cost a manufacturer $150 million dollars. Manufacturer’s may spend another $150 million to place the satellite in orbit, approximately 22,380 miles above the earth. To recover costs and make a profit the satellite provider sells his product -
Question: Wow—I can't afford that. It's out of my price range. Isn't there a less expensive solution?
Answer: Yes, bandwidth providers created a solution allowing them to amortize the costs across many users simultaneously — and provide a level of 'shared service' that is appropriate for your application, as well as your budget.

Question: What is a shared service?
Answer: A simple analogy for shared service would be old technology telephone system party lines. Simply put, multiple users have access to the same bandwidth, and it's shared by a group. When someone else isn't using it—you can. Inexpensive bandwidth may be shared at a 100:1 ratio. This means up to 99 other customers may be contending for the same bandwidth as you; hence, the contention ratio - 100:1 - indicates the “oversold” condition of the service.

At 100:1 it is impossible to use VoIP. TracStar has services that vary in oversubscription ratios, but offers plans under 12:1, meaning your VoIP experience may be much like a normal telephone conversation.

Question: Are all shared services bad?
Answer: No. Most of the bandwidth services sold fall into the shared service category, because the sharing actually reduces the monthly recurring costs and helps make it affordable. The task at hand is to determine the balance of quality of service versus monthly fees. The balance may vary per user as decisions are made regarding criticality of the uptime and integrity of the communication link. During emergencies, lives may be at stake and quality of service is paramount to most users.

Question: How can I determine if it is a good shared plan?
Answer: In part the answer lies in how you are going to use the service. Point-to-Point purchase transactions require very little bandwidth compared to VoIP (Voice over IP) requirements or video solutions. Each has its own merit. Point-to-Point will work with a high contention ratio — but VoIP won’t. The solution needs to be tailored to users needs.

Question: I want to use VoIP. And the Internet. What do I need? Can I do it on a shared plan?
Answer: Again, refer to your list of requirements - the list helps determine how your bandwidth will be allocated. VoIP solutions vary from equipment provider to equipment provider. It is important to remember, the satellite modem and antenna simply provide a means to transmit and receive data at a remote location. Generally speaking, it is the peripheral equipment attached to the antenna and modem which determine how efficiently the bandwidth is being used. Some VoIP solutions require more bandwidth per phone call than others, which would impact the number of phones that could be used concurrently at any given bandwidth level. VoIP phones require anywhere from 8 Kbps (8 thousand bits per second) per phone call to 90 Kbps. The technology simply varies from one solution to another. You can do VoIP on a shared plan, but success will also be based on how many other users are vying for the bandwidth at the same time, again the oversubscription ratio of the service.

Question: Why use equipment that requires 90Kbps if I can use equipment that does the same thing at 15Kbps?
Answer: The variety of solutions allow users to select preferred equipment and tailor systems to their specific needs. Demands for equipment compatibility and known reliability may outweigh solutions deemed riskier because an equipment supplier is less well known by a specific IT group. Details such as VPN’s or encrypted voice conversations over satellite requiring more bandwidth than un-encrypted voice assist in shaping the users bandwidth needs; hence, the application suggests a system level design approach. Still others feel their sampling rates must be higher to have a ‘good’ phone call. And, one can improve the bandwidth experience by choosing a plan with CIR.

Question: I’ve heard about CIR—what is it?
Answer: CIR stands for Committed Information Rate. If your service provides CIR for your transmit side bandwidth - or inbound traffic to the hub - the value is the non-shared portion of a shared bandwidth structure that the carrier is obligated to provide to the subscriber at all times. Hence, a 384/1500 Kbps service indicates the 384 Kbps is bandwidth dedi-
cated to your modem as long as the modem is active in the network. So you have a dedicated portion of the shared bandwidth pool. A simple analogy would be that CIR provides you head-of-line privileges at Universal Studios—every time the roller coaster takes off—you get to ride.

**Question: What happens with non-CIR shared users then?**
Answer: Non-CIR subscribers share the remainder of the service providers available bandwidth from a pool that dynamically shrinks and grows as CIR subscribers enter and leave the network.

**Question: What is a FAP - Fair Access Policy?**
Answer: Shared services typically employ a FAP (Fair Access Policy) that prohibit users from excessive usage such as providing ISP services to users or allowing streaming video applications, particularly broadcast quality video. As shared service plans are in fact intended to share, allowing either of these two activities tends to reduce available bandwidth to the other shared users in the group. Video streams may be achieved for video teleconferencing and security level video transmissions as the Kbps and frame rate are adjusted to a level where flicker and frame rate are acceptable to the users objective and not objectionable to the satellite service providers FAP policy intent. Should the provider determine excessive bandwidth is being used in violation of the FAP, they may ‘throttle’ the service, limiting the satellite service performance to a restricted level.

**Question: Are there part-time bandwidth plans available?**
Answer: Yes. TracStar was the first company to develop satellite service plans aimed specifically at the part-time user market. With the satellite services we provide, there are: full monthly plans, 5 day and 10 day plans. All are designed to provide the same quality of service but for needs that don’t demand full time usage and still accommodate a modest budget.

**Question: Are there Month-to-Month plans? I just want to use it during hurricane season.**
Answer: They are available, but not from all providers and on a very limited basis. The monthly rates will have a slight increase over published rates in our Service Matrix and a 30 day written notice is required to terminate the service. Minimum service period is 2 months.

**Question: Can I increase my bandwidth at all?**
Answer: Answers vary depending on the service provider you’ve selected. In general, there are a couple of options from various providers. If you have a full monthly plan, your bandwidth may be able to be increased, but it will be for a minimum of 2 months, as it requires a 30 day written notice to return it to the original contract level. Some Restoral Plans (5 & 10 day plans) allow for temporary increases. The minimum increase is for the billing month for which the service was increased. The maximum is defined by the users need. Service can be bumped to any level that the antenna and its hardware will allow. For example, a standard TracStar960 with the TracVSat hardware set at a 128/512 Kbps level of service can be increased to the 512/1500 Kbps level of service with a phone call to TracStar. A service charge for an immediate increase (less than 36 hours notice) in bandwidth may be applied to the respective months billing. Monthly billing and overage charges for that month will change to the level commensurate with the level of temporary service requested. However, it is important to note, increasing your bandwidth means your antenna configuration must conform to the requirements for the higher level of bandwidth. In other words, the antenna size and the BUC (transmitter) size must be sufficiently sized to operate in the network at the higher bandwidth level. If you believe you may need to increase your bandwidth, it is important to design the system for operation at worst case scenario levels but for daily operation at nominal.

**Question: What is ‘delay’ relative to satellite technology?**
Answer: The satellite is in a geostationary orbit over the equator—meaning it moves at the same rate the earth rotates—so it is always in the same place in the sky. The delay is incurred due to the time it takes a signal to transit from earth to the satellite (about 22,300 miles from the equator) and from the satellite back to earth (another 22,300 miles). The delay from this ‘hop’ is unavoidable and amounts to approximately 1/2 second.

**Question: What problems can I expect from this delay?**
Answer: It will be noticeable in VoIP phone conversations as a slight latency. It is virtually unnoticeable in normal Internet surfing or FTP (file transfer protocol) activities. It may cause issues with VPN applications, as network hardware interprets the delay as excessive traffic and slows down
network activity in general - essentially creating a delay because of the delay.

**Question: Does that mean I can't use a VPN?**
Answer: No, in most cases VPN's will still run as there are ways to lessen the impact of delay depending on equipment and service. They may require 'tuning' to adjust system timeouts. Newer VPN technology introduces satellite friendly appliances that encrypt information yet allow for native acceleration in the modem to enhance the VPN experience. VPN's require overhead and as such consume bandwidth. We strongly encourage customers with VPN requirements to contact TracStar so we may assist in engineering a satisfactory solution.

**Question: I want to stream video. What does it take?**
Answer: Streaming video is engineered on a case-by-case basis. Contact TracStar to begin developing your solution.

**Question: Why do I need to sign a contract or agreement?**
Answer: To properly manage the oversubscription ratio of subscribed bandwidth, the satellite service provider needs to have a thorough understanding of his total capacity in bandwidth and his total potential demand from clients. He too must pay for bandwidth from the corporation that owns the satellite, so holding bandwidth in reserve without fee for clients that 'may' use the service is not economically feasible.

**Question: What is a HUB? NOC?**
Answer: Service providers establish an earth station or HUB, a very large ground based antenna, to communicate with the satellite. The service provider purchases satellite space on transponders or time-share slices on a transponder to be able to send your information from point A to point B. The term "NOC" or Network Operations Center refers to equipment and personnel at the HUB which are responsible for the day to day operations and health of the network in terms of keeping equipment operational, minimizing down time, implementing upgrades, supporting clients and managing the bandwidth itself. Sophisticated software will indicate the number of users on-line, the total (and individual) bandwidth being consumed, the total available bandwidth and many other details that allow for the seamless operation users experience on a typical day - or during serious events such as a major hurricane.

**Question: What is a satellite footprint? Link-budget?**
Answer: A footprint is a map of the satellites signal strength at specific terrestrial locations in areas covered by the satellite. The signal strength will determine the size of the antenna required to receive signals from the satellite. The service provider will run a link-budget for specific locations, using information such as the data rates required and the antenna size desired and assume you want at least 99.5% up time. In turn, mathematically he'll determine what size transmitter is required for that antenna size, if you need a larger/smaller antenna, and what the maximum data rates will be for that antenna. When purchasing bandwidth from TracStar, link budgets are already developed for most applications. For higher bandwidths or special needs, we'll ask the service provider to run a link-budget to firmly identify the specific requirements for a specific application.

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**GLOSSARY**

**ANTENNA**
A mechanism for transmitting and receiving signals. An antenna may be part of an earth station or a remote site that communicates with the earth station via the satellite.

**BACKHAUL**
A terrestrial communications channel linking an earth station antenna to a local switching network or population center.

**BANDWIDTH**
A measure of spectrum (Frequency) use or capacity. For instance, a voice transmission by telephone requires a bandwidth of about 3000 cycles per second. (3 KHz)

**CHANNEL**
A frequency band in which a specific broadcast signal is transmitted. Channel frequencies are specified in the United States by the FCC.

**DOWNLINK / INBOUND**
The link from the satellite down to the earth station.

**EARTH STATION**
The buildings, hardware, software and antennas used to communicate with a satellite.

**FDMA**
Frequency Division Multiple Access. A method of sharing a channel by assigning different frequencies to different users.

**FOOTPRINT**
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The area of the Earth’s surface from which an Earth Station can transmit or receive from a particular satellite.

**FREQUENCY BANDS.**

Internationally, frequencies are divided into well-defined-bands. For satellites, the relevant bands are:

**L-Band**
The IEEE 521 standard defines L-Band as the frequency range from 390 MHz to 1.55 GHz. The term is also used to refer to the 950—1450 MHz frequency range used for mobile communications. L-Band is used for mobile satellite services and offers good penetration through adverse weather conditions and foliage.

**C-Band**
The frequency range from 3.7 to 6.2 GHz. Transmissions are less affected by atmospheric conditions such as snow and rain. C-Band transmissions, however, have low power, so Earth Station must be rather large to compensate dish size. Applications include public switched networks and Internet Trunking.

**X-Band**
The frequency range from 8.0—12.0 GHz. The X-band frequency enables high power operations with very small terminals. Applications include COTM, manpacks, emergency communications and airborne and shipboard platforms. Xband is also less vulnerable to rain fade and adjacent satellite side lobe interference that other frequencies.

**Ku-Band**
The frequency range from 11.7 to 14.5 GHz. Ku-band. It has higher power than C-band, allowing for smaller dishes to be used. Primary uses and include high-bandwidth Internet, video teleconferencing, and multimedia applications. Ka-band transmissions are more sensitive to poor weather than Ku-band.

**HUB**
The master station through which all communications, to, from and between terminals must flow.

**Kbps**
Kilobits per second. Refers to transmission speed of 1,000 bits per second.

**kHz**
KiloHertz. One KiloHertz is the equivalent of one thousand Hertz, or one thousand cycles per second. Used to measure frequency and bandwidth.

**LAN**
Local Area Network. A geographically localized network.

**MHz**
Megahertz. One Megahertz is the equivalent of one million Hertz, or one million cycles per second. Used to measure frequency and bandwidth.

**SPOT BEAM**
A satellite beam with concentrated geographic coverage. e.g., coverage for an island or specific geographic territories within a larger land mass.

**TDMA**
Time Division Multiple Access. A way of sharing a channel by assigning different time slots to different users.

**TERMINAL**
One of the communications stations that receives, processes and transmits signals between itself and a satellite.

**TRANSPONDER**
A device located on board the satellite which receives signals unlinked from an earth station and transmits them back to earth on a different frequency.

**UPLINK / OUTBOUND**
The link from the earth station up to the satellite.

**VSAT**
A Very Small Aperture Terminal, referring to small earth stations, with antennas in the 1.2 to 2.4 meter range. Small aperture terminals under 0.5 meter are sometimes referred to as Ultra Small Aperture Terminals.

**WAN**
Wide Area Network—not geographically localized to a small region, but encompassing all aspects of a network on a global basis. May be comprised of multiple LANs.

**WiFi**
Referring to a wireless device, such as a computer, telephone, PDA, Blue Tooth device, etc, empowered by a WAP.

**WiMAX**
Wireless communications technology that provides high-throughput broadband connections for considerably longer distances than that offered via WiFi (Wireless Fidelity) LAN (Local Area Network).