IP Satellite Reliabilty, Availabiltiy, and Serviceability
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This document is meant for field service and marketing personnel of CPE Labs. It is not meant for general distribution. It contains information gleaned from personal experiences with IP Satellite services and serves as an aid in the selection of the proper service for a given user requirement. This document is not meant to endorse one vendor's product over another even though such comparisons are difficult to avoid with such a marketing tool.

This document is very much in its infancy and the reader will note many areas where further testing and evaluation are required.

Please submit any corrections or modifications to the author for future inclusion.

This document is a summary of Reliability, Availability, and Serviceability (RAS) for the selected IP Satellite products. Please refer to the detailed IP satellite service provider documents contained in this web site for further detailed information.

Percentage of 60 points
95-100 A+
90-95 A
80-89 B
66-79 C
51-65 D
<51   F

This document rates satellite providers, commercial or residential, on the same scale. One should not expect a system that costs $600 to perform at the level that one does when it costs 2-4 times as much. What the buyer should do is examine comparative services in their price range and then determine the importance of specific reliability items to their own requirements. For instance, one customer may find customer support more important than consistency of delivery.

Grade Grid

Service	Cost	Points	Grade
HughesNet (Direcway)	$600	35 of 60, 58%	D
SkyVista	$1200-$2000	41 of 60, 68%	C[1]
Skyway	$300	36 of 60, 60%	D
Starband	$600	34 of 60, 56%	D
VSAT Systems	$2000-$3000	56 of 60, 93%	A
WildBlue	$500	46 of 60, 76%	C[1]

[1](Note: Both SkyVista and WildBlue use a ViaSat modem that provides no end user interface. If this is not important to the customer then these services would score a full grade point higher than listed above.)

Ping Test
20 points
The Ping Test provides a measure of latency and overhead involved in an IP satellite offering. This chart also includes information relating to measured bandwidth delivered by a selected service offering.

Where we are

Location	Latitude	Longitude
Direcway NOC, Germantown, MD.	39.19ºN	-77.24ºE
CPE Labs, New Castle, KY.	38.433ºN	-85.170ºE
SkyVista NOC, Wisconsin Rapids, Wis.	44.3454ºN	-89.7276ºE
Skyway NOC, Ellenwood, Ga.	33.6166ºN	-842939ºE

Starband NOC, Marietta, Ga.	33.959ºN	-84.536ºE
WildBlue Syracuse NOC	43.05ºN	-76.15ºE
VSAT Systems NOC, Akron, OH	41.084ºN	-81.514ºE

How far we have to travel

Location	Satellite	Distance to Satellite	Roundtrip Speed of Light
Direcway NOC	Satmex5 – 116.8ºW	38692.47Km	257.95ms
CPE Labs	Satmex5 – 116.8ºW	38214.92Km	254.77ms
CPE Labs	Horizons1 – 127ºW	38788.62Km	258.59ms
CPE Labs	PAS1R - 45ºW	38685.26Km	257.90ms
CPE Labs	IA-8 – 89ºW	37373.55Km	249.16ms
CPE Labs	Telstar (IA) 7 – 129ºW	38868.88Km	259.13ms
CPE Labs	Anik F2 – 111.1ºW	37904.46Km	252.70ms
Starband NOC	Telstar (IA) 7 – 129ºW	38731.19Km	258.21ms
Skyway NOC	Horizons1 – 127ºW	38591.51	257.28ms
SkyVista NOC	IA-8 – 89ºW	38213.93	254.76ms
WildBlue NOC, Syracuse, NY	Anik F2 – 111.1ºW	38682.51Km	257.88ms
VSAT Systems	IA-8 – 89ºW	37636.99Km	250.91ms

Over head in delivery

Service	Specification	Downlink/ Uplink	Ping to NTI	Min. Transit	Ping to web site	Grade Points
Skyway Silver (512Kbps)	Horizons 1, .75m Dish	201-490Kbps/18Kbps	1.218ms	515.87ms	100% Loss	12
AT&T dial		20Kbps/18Kbps	100% Loss		224ms	
Direcway Residential DW6000 (500Kbps/50Kbps)	Satmex 5, .74m Dish, 1130MHz RX	579Kbps/15Kbps	6.655ms	512.72ms	940.492ms	15
Direcway Small Office DW6000 (1Mbps/100Kbps)	.98m Dish		6.6ms	512.72ms		
SkyVista SOHO SurfBeam (.5Mbps/128Kbps)	IA-8, 1.0m Dish	.506Mbps/114Kbps	2.35ms	503.92ms		17
Starband Residential Model 360 (500Kbps/100Kbps)	Telstar 7, .75m Dish, Cluster 7, Subcluster 8	594Kbps/48Kbps		517.34ms	640-1340ms, 30% loss	15
VSAT Systems iDirect 3000 (1.02Mbps/64Kbps)	IA-8, .74m Dish	905Kbps/40.3Kbps	<1ms	500.07ms	635ms	18

WildBlue ValuePak (512Kbps/128Kbps)	Anik F2, .75m Dish, Beam 36	448Kbps/92Kbps	2.35ms	510.58ms	1352ms	19
WildBlue SelectPak (1Mbps/200Kbps)	Anik F2, .75m Dish, Beam 36	844Kbps/111Kbps	2.35ms	510.58ms	1076ms	19
WildBlue ProPak (1.5Mbps/256Kbps)	Anik F2, .75m Dish, Beam 36	1.531Mbps/229Kbps	2.35ms	510.58ms	743ms	19
127.0.0.1		Localhost	.325ms		N/A	

Phys: Physical specifications first distance to satellite from transmit location, speed of light time to travel transmit uplink to satellite and back to earth station or 1/2 of 2 way transmission. Data from http://www.satlex.net/en/azel_calc.html .

Customer Service
   10 Points Dealer Service
Service of dealers and customers is important. The importance of dealer support reflects in the level of local service one can expect, the level of customer service can reflect in how the service provider can meet the out of service expectations of the customer.

HughesNet (Direcway). This company has a paradigm of not dealing directly with customers or dealers. They have outsourced all customer and dealer contact to third parties. They have also an internal culture that precludes one division from communicating with any other division. For instance, the national sales group is unable to contact any of the network engineers to obtain even simple documentation or answer technical questions. It is hard to imagine a company so communicationaly dysfunctional that it would ever be an effective service provider. They have been lucky from a marketing stand point in that they have nearly had an absolute monopoly from 2001 to 2005 coupled veritable free marketing on DirecTV. The companies they outsourced their customer contact to have done quite well given their sometime inability to get answers to questions that they pose. If it were not for their valiant effort we would have to give this company 0 points for customer support. As such, we do give them 2 points.

SkyVista. This is a fairly new startup commercial company. They are small and have subcontracted their 24x7 help desk to another firm that seems to be staffed with people of adequate knowledge about their product. All of the support staff is located in the United States and they depend upon their commercial dealers for a lot of the customer support. They use a cable modem technology NTI from ViaSat, a brother unit to the one manufactured for WildBlue. At this time the dealers do not have access to the DOCSIS data to provide first level support to their clients as WildBlue has done. Barring that we give them 8 of 10 points.

Skyway. This is a fairly new start up company . They do not maintain a 24 hour technical support line. Their technical support is available from 9AM-9PM EST Monday through Friday and 11AM-9PM EST on Saturday – or, whenever their technical support person comes in to work. Their user base is 60% Bronze level 256Kbps - casual internet browsing users. One might expect their support lines would be monitored during the hours when their customer base was home in the evenings and week ends. We have found their technical support people helpful but oriented toward a very non technical client base – as can be expected from their target market. We have had difficulty determining why

the system does not maintain a reasonable stated bandwidth with their support group and we suspect they do not have visibility into the utilization of their transponders and supporting network. We give them 6 points on this category.

Starband. This service provider does provide an American help desk. Their customer support is available and knowledgeable. Some of their major problems revolve around delivery consistency and a shrinking subscriber base. As a company they are more focused on their commercial customers and appear to have ceded the residential market first to Direcway and then to WildBlue. We give them 6 of 10 points.

VSAT Systems. This provider is making the transition from a Direcway backed satellite backbone to one of their own. They maintain a 24 hour helpline manned by their own technician's. At times they are busy but we have always found them to not only be helpful but be able to control all aspects of their network for problem determination unlike any other satellite ISP that outsource their help desk. We give them 10 of 10 points on this item.

WildBlue. This is a fairly new start up company. Their stated intent is to be customer driven. All of their support is handled through their dealer network and a 24 hour hotline that is staffed totally within the continental United States. Because their NTI is based upon cable modem standards they have significant information available for problem determination. They have also taken a brave step to allow this information to be available to their dealers so that they can serve as a front line support for their customers. Because of their openness and dedication to customer support we give them a 10 of 10 points on this item.

Delivery Consistency
10 Points
Measured bandwidth variability over time
Measure tests over 15minutes
Low variability good, high bad.
Consistent service provides expected user response times

HughesNet (Direcway). Bandwidth consistency over time has been very stable. However, as Direcway deploys their new customers on a given satellite and transponder they have a tendency to over book the bandwidth capacity that is there. For those that have transponder assignments on the "old" birds there is a delivery consistency that gets better with time as more people drop the service and are removed from bandwidth competition. We must mention another recent development that has affected users perception of delivery consistency. With the introduction of the DW7000 as a replacement to the DW6000 there has been a slow build out of the older transponders and gateways capable of supporting this newer DW7000. Generally, Direcway allows users to upgrade a DW6000 to a DW7000 and performs a transponder change on the same satellite under the covers. This means that the same satellite that had multiple transponders servicing all of the DW6000 customers finds the overload situation growing worse as they are

commissioned onto only one of the transponders that corresponds to the upgraded gateway that accepts the newer DW7000. Direcway should have modified all transponder/gateway(s) to accept the newer DW7000 before they allowed users to upgrade. If it were not for this delivery foible Direcway would have scored higher on this item. Score 6 of 10.

SkyVista. Being a commercial product the consistency of their delivery is paramount to their success. They market their product with a stated quality of service and that business users will be tiered with only so many other users on a given transponder. We have encountered some problems with SkyVista being able to meet their stated bandwidth goals on the lowest bandwidth packages. Most of the difficulty stems from the growing pains of a new company and how the satellite industry seems to attract some individuals that will try and consume bandwidth far in excess of a normal usage paradigm. Score 8 of 10.

Skyway. Bandwidth delivery has been inconsistent. We have measured service delivery at under 1/2 stated bandwidth to 95% of marketed bandwidth. Without being able to verify if the account has been under their RUP policy it leaves the consumer very concerned with bandwidth delivery really being delivered at what they are paying for. Score 4 of 10.

Starband. Consistency of delivery is probably one of the biggest factors affecting customer service for this ISP. Bandwidth tests of their product line shows them to be competitive with their closest competitor, Direcway. They have elected to only recently institute a fair access policy to deliver quality of service across their users to provide a consistent user experience. Users tend to remember the times when their service was slow because of over utilization of available bandwidth rather than the times when they were delivered service in excess of their target. Score 3 of 10.

VSAT Systems. This provider is a commercial provider. Delivery consistency is of prime importance to them and we have not encountered any out of normal conditions where they have not provide a reliable service to their customers. They may not deliver 110% of rated bandwidth but the speeds they do deliver are consistent and predictable by the user. Score 9 of 10.

WildBlue. This ISP has been operational for only a brief time. We are encouraged that they are taking delivery consistency seriously. We have heard of situations in the country where they have ceased selling additional customers into "spot beam" areas of the country that have reached their saturation point. We know that their competition has no such compunction. WildBlue considers this factor to be one of their selling points against their prime competitor, Direcway. We have noticed that their service is experiencing the growing pains of a new provider. The service, at this point, does suffer from more outages than HughesNet does but we are only marginally concerned as it is just their first full year of operation. Score 8 of 10 points.

User NTI Interface (10 points)
An educated user is a constantly complaining user…

Direcway. The Direcway NTI, the DW6000 and DW7000, have a browser interface that provides the user with information on the status of the service reception and transmission. They do miss label the signal quality factor as "Signal Strength" when in fact it is not. This does cause confusion with novice users. The user has no real ability to control any function of the NTI from the browser interface. The user is unable to reset counters or restart the NTI. Over the years Direcway has taken a stated effort to remove any local control over these NTIs. It would at least be nice to be able to control DHCP functions. With the interface providing only status information and no real control function we give this unit a grade of 5 out of 10 points.

SkyVista. Just as WildBlue provides no end user interface to their ViaSat NTI neither does SkyVista. We feel that some interface should be provided to give the user an indication that the NTI connection is up, degraded, or down. Score 0 of 10 points.

Skyway. The SW10 satellite modem has a browser interface that the user must use to initiate and terminate the dial connection. We would prefer that this unit have an automatic connection ability where it would initiate and terminate the dial connection as it was needed. The Browser interface offers no user information of use except dial connection status and a very casual signal strength bar that really can be used for no more than make the customer feel good that some signal is being received. There are interfaces to other more useful information but it is buried in hidden areas on the browser interface. Their stated intention is to give the user just enough information to let them know that there is a connection. They are leery of providing their customer base with more ability than necessary as they feel the casual browser may not be technically literate enough to not get themselves in more problems than they can solve. Also, some of the intended browser interfaces do not work at the time of review. Score 6 of 10 points.

Starband. The interface is adequate but somewhat dated on the USB modems. The Ethernet modems have a helpful more modern software interface. The user is given just enough information without being able to control the functioning of the unit in their LAN. Score 6 of 10.

VSAT Systems. The iDirect satellite modem has a very detailed user interface. It even reports on the temperature of the room that the modem is located in. The only piece of information not provided are the cloud formations between the dish and the satellite. Score 10 of 10.

WildBlue. There is no end user interface available with this unit in keeping with its cable modem heritage. The user is forced to call their dealer or WildBlue if service is interrupted. We just feel better with some user information were provided, no matter how scant. Especially in the microwave vsat world. It was difficult to determine how to grade this as the service was designed from the beginning to not provide an end user interface. This would be a good place for WildBlue to put in a software interface that provides educational menus and product status information just as Starband has done with their newer Ethernet NTIs. In the end we must give the ISP 0 points of 10.

Weather Stability (10 points)

Any satellite based system will have some measure of difficulty when the atmosphere becomes saturated with moisture that can scatter microwave frequencies. Surprisingly though nearly all of the difficulty rests with the transmission segment from the customer's site to the satellite from a Very Small Aperature Terminal (VSAT) dish. The low wattage and sometimes imperfect pointing of the dish make for difficult data path on uplink. The better the dish is peaked for cross polarity the better it will be able to withstand inclimate weather conditions.

If the installer uses a high quality meter, such as the BirDog® even the .75 meter dish can maintain a high degree of weather stability. The simple fact to remember about dish alignment is that it is only marginally important what the signal strength is at the VSAT dish on the ground, what is of prime importance is the signal strength at the receiving satellite. Many times the installer must de-tune the earth bound VSAT dish in order to achieve the highest signal to noise ratio at the satellite.

Weather over the ISPs main Network Operations Center (NOC) can cause an outage over their entire satellite network.

HughesNet (Direcway). Direcway has a single uplink facility on the east coast. If weather knocks out this uplink then the entire Direcway satellite network is down. The VSAT dishes have a critical cross polarity pointing requirement in their ability to maintain transmit during heavy rain, or snow, precipitation. Most weather outages are from 10-15 minutes. We set –2 points for a single NOC in a weather prone area of the country and –1 point for the dish and transmitter pair. Total score 7 of 10.

SkyVista. This commercial offering uses true commercial dishes, electronics, and mounts. They generally install their 1.2 meter dishes on a pole mount, 3 inch outside diameter pipe buried in almost 500 pounds of concrete and designed to withstand 125 mile per hour winds. Still, torrential downpour can cause an outage and they use a single uplink at this time. Score 8 of 10.

Skyway. This satellite product has the best weather stability of any other satellite product in the consumer market. When most consumer grade systems are knocked out by weather the Skyway system can maintain connection. This is a result of the uplink path being over dial up lines and a receive dish that is large for the industry. All IP satellite systems have "rain fade" on transmit and since the transmit path for Skyway is over dial up lines then rain has no effect on it. With their large surface area dish your DirecTV signal will go out before your Skyway signal will. The SW10 satellite modem does support a dial only connection. We would like to have seen the unit have a failover capability that if the satellite link is broken that the unit would automatically establish a total dial up connection. The SW10 lives up to its manual nature in that the user must manually realize the satellite side is down, disconnect the link, change a configuration setting on the browser window, and initiate the total dial connection. Also, the large surface area of the

dish and the rather "cheap" mount used results in dishes "drifting" off satellite over time because of wind. We score this unit a 8 of 10 points.

Starband. We have fielded more complaints about weather outages with this service than their competitor, Direcway. We believe the problem stems from the fact that the ISP does not provide a reliable on-site pointing capability to allow the installer to precisely point the dish. Without accurate pointing the cross polarity transmit problem will push the dish to its limits in trying to maintain communications. If the dish is accurately pointed this service should be as reliable as any other .74 meter dish vsat consumer system. Score 4 of 10.

VSAT Systems. This company claims that the iDirect modem and transmitter virtually eliminate rain fade. We have yet to hear of a weather related outage but we are hard pressed to believe this one. Still, score 9 of 10.

WildBlue. WildBlue has 5 separate uplink facilities. We are uncertain if this was done for capacity design considerations or to provide uplink redundancy. At present we believe that weather over any single NOC uplink could knock out all of the beam assignments serviced by that NOC. We do not know if fast failover has been built into the system to allow one of the NOCs to take over the assignment of a failed NOC. At this time we believe such a failover is not built in based upon the outage patterns we have observed. Closer to home the small VSAT aperture is somewhat offset by the use of circular polarity. Rain fade will still be an issue but we do not have enough information to determine if this ISP will suffer more or less than any other ISP. Score 9 of 10.

Network Settings

There seems to be increasing difficulties with Windows operating systems and satellite broadband. It appears to be default MTU settings in Windows, routers, or other network definition files. The default setting of 1500 is ideal for a local area network connection but can cause moderate to severe performance impacts to the satellite broadband user. User should adjust the default setting from 1500 down in increments to 1100 or until their bandwidth performance improves.

<u>Services</u>

The next section of this document attempts to recommend a satellite service based upon the application or function they are to be used for.

VOIP. All residential service offerings do not specify that their service will work with VOIP. This includes Skyway, HughesNet (Direcway), Starband, and WildBlue. There are many factors relating to successful VOIP traffic across a satellite link. The most important is the variance in upload speeds (VOIP parlance, jitter). Since upload speeds are a highly competitive and difficult resource for residential systems VOIP performance can seem to vary from being good to unusable. Also, all satellite systems suffer from terrestrial delay. We hear many stories of VOIP connections working for some clients using the same hardware/software talking to others both successfully and unsuccessfully. Since the residential services do not support VOIP then we have not tested further and the consumer is left to their own devices as to the success or merit of this application. If VOIP is important than we suggest that one look to the commercial providers such as SkyVista and VSAT Systems that have a stated support for VOIP.

When using any connection oriented service keep in mind that more than one connection attempt may be necessary to get adequate voice service. Even land lines today have many switching inconsistencies that involve connections where one or the other party can not understand the conversation. All VOIP does is add TCP/IP to the switched network and it does nothing to improve the basic telephone system that is used in completing calls.

> Crystal Voice: Direcway, Starband, WildBlue. All suffer terrestrial delays. All provide unreliable service.
> Packet8: Direcway, Starband, WildBlue. All suffer terrestrial delays. All provide unreliable service.
> Skype: Direcway, Starband, WildBlue. All suffer terrestrial delays. All provide unreliable service.
> Vonage: Direcway, Starband, WildBlue. All suffer terrestrial delays. All provide unreliable service.

Packet8, WildBlue. Testing has begun on this combination. Packet 8 documentation requires a 256Kbps symmetric link as a minimum. The WildBlue ProPak may provide the minimum uplink capability required.

VPN. All residential service offerings do not specify that their service will work with VPN. This includes Skyway, Direcway, Starband, and WildBlue. There are many factors relating to successful VPN traffic across a satellite link. The most important is the terrestrial delay. Delay is very important to the success of VPN traffic, especially IPSEC VPNs. Many residential services give the option to individual companies to put in a dedicated line from their site to the uplink NOC so that VPN delay considerations can be minimized. The cost for such connections places this option out of the reach of most companies. Since the residential services do not fully support VPN then we have not tested further and the consumer is left to their own devices as to the success or merit of

this application. If VPN is important than we suggest that one look to the commercial providers such as SkyVista and VSAT Systems that have a stated support for VPN.

> IPSec: Direcway, Starband, WildBlue. Most hardware based (used in most large corporations) IPSec VPN systems function. However, response time is degraded and may appear as slightly faster to slightly slower than dial up. Commercial services such as SkyVista and VSAT Systems have built VPN accelerators into their networks and response time suffers only from terrestrial delay.
> SSL: An SSL VPN functions much better in the satellite world. However, most corporations do not have or support SSL VPNs. If possible, sell a Juniper SSL VPN appliance to the corporate user base.

Cisco VPN Client: Some users have had success setting the MTU setting from 1500 to the smallest setting possible under their specific version.

Citrix. This PC server based application is not conducive to any broadband delivery method in its local network variation. This application functions by replicating a virtual PC desktop with server based PC applications that are executed across the network. Every mouse movement and key stroke must be sent across the network to the server and then echoed back to the remote workstation. For local network attached workstations this is quite fine in high bandwidth low latency networks. Broadband connections introduce latency that becomes more noticeable with increasing distance. Specifically for satellite systems this application introduces a considerably higher transmit requirement than normal browsing applications and users can expect to have type ahead lags in their interactions. This application needs at least 1Mbps asymmetric with at least 200Kbps uplink speed to be barely usable. Customers should ask their IT staff to install a Citrix Wide Area Network compliant version of the code for use across the internet.

GoToMyPC: This product is meant to be used over the internet but it is not designed with the bandwidth conserving features one would expect. Every mouse movement is transmitted across the broadband connection and the results are transmitted back to the display engine. This product requires a low latency uplink. Satellite Return Systems (SRS) do not function as well as a Satellite Receive (SR) system. For this application the 1 way SkyWay system performs better than any 2 way systems can.

PCAnywhere: This product functions better across satellite systems as it does have built in broadband conserving features.

ITVN. Interactive Television Network is a streaming audio/video service that delivers television programming via broadband internet connection. This application works best with a broadband downlink delivery of at least 1Mbps. The service is very reliable and works better than one would expect due to the dedicated set top box employed in the service delivery. They offer three bandwidth quality of service deliveries: 300Kbps, 400Kbps, and 500Kbps. For any chosen bandwidth delivery the consumer should have at least double the bandwidth downlink speed. For instance, 300Kbps should have a reliable, sustainable downlink bandwidth of at least 600Kbps. We have measured the 300Kbps service as normally consuming around 275Kbps and being quite usable on all

satellite based ISPs, even the one way systems that use a dial up return path. The user should be aware that if their ISP does have in place any Fair Access Policy (FAP) then they could evoke such bandwidth constraints after only 1-2 hours of continuous streaming content.