



Broadband Connect and Clever Networks Discussion Paper

IPSTAR Response

18 January 2006

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1 INTRODUCTION

IPSTAR is pleased to respond to DCITAs discussion paper Broadband Connect and Clever Networks: Supporting Investment in Sustainable Broadband Infrastructure dated November 2005.

This document contains IPSTAR's general response, but does not include confidential commercial material. Supplementary commercial material will be made available separately.

2 THE NEED FOR SATELLITE BROADBAND

Regardless of the rollout of terrestrial broadband, the economics of our vast continent mean it would be prohibitive to reach all of remote Australia. Satellite technology is uniquely able to deliver ubiquitous broadband to all Australians.

DCITA has its own estimates, but IPSTAR believes currently between 500,000 and 800,000 sites are not able to access terrestrial broadband. Many are in discreet isolated locations or very small communities, and are unlikely to be attractive for terrestrial infrastructure build. Yet these are in some cases, important business operations contributing to our economy. Others are some of the most disadvantaged Australians, unable to meet pricing for necessary services at a premium over prices paid by the majority. These remote locations make the need for high quality communications even more of an essential service, not only for business, home organizational and social needs, but also increasingly for educational or service delivery needs.

Satellite has, with older generation technology, usually meant limited performance and scalability. Users of this generation of technology will be left with significantly inferior services as usage patterns increase and urban users adopt new broadband applications.

However, new generation satellite broadband can deliver high performance demanded by end users.

The launch of the world's largest civil communications satellite to date, IPSTAR 1, on August 11th 2005 has facilitated availability in Australia of dramatic increases in satellite capacity.

If broadband penetration over time reaches the projected 50% of 500,000 potential satellite sites, then 250,000 services could be required. If those



services are dimensioned to provide for broadband usage comparable to terrestrial, then IPSTAR estimates approx 2500 Megabits/sec of forward capacity would be required. This is the equivalent of a number of conventional satellites, and no plans are known for investment in such capacity.

IPSTAR brings for the first time the ability to deliver significant bandwidth into locations suitable for local redistribution. Locations away from existing terrestrial capacity can use IPSTAR to access multi megabit services, which may feed local wireless broadband, local GSM mobile phone cells etc. Remote communities can get the range of modern communications services quickly and cost efficiently without the need to develop expensive connecting fibre.

To secure the ability to deliver equitable broadband to these areas in terms of performance and price, the only viable option is IPSTAR.

IPSTAR has made its own large investments to make the satellite infrastructure available in Australia. The satellite payload has been developed and launched. Two gateways necessary to manage and interface to service provider networks have been constructed in regional Australian locations - Broken Hill and Kalgoorlie. The highly advanced ground systems and user terminals have been developed and made available to a growing number of authorized service providers.

Regardless of access technology or target area, the ability to deploy a large scale mass market broadband network is dependent upon platform scalability, service performance and service cost. These three key elements represent IPSTAR advantages. In this respect IPSTAR believes that its services can be deployed in most of the Broadband Connect target area as competitively as Terrestrial Services.

Broadband Connect provides an opportunity to complement the investment by IPSTAR to utilise this new infrastructure to deliver low cost, equitable broadband to all Australians.

3 SUBSIDY LEVELS

IPSTAR analysis suggests that with the current market structure, and assuming similar rates of sales to those seen under HiBIS, there are limited opportunities to substantially reduce the subsidy level. However, IPSTAR believes it is in the interests of all to achieve a lower cost structure in broadband satellite in order to both extend the number of end users able to be supported under Connect Australia, and also to make broadband satellite an attractive solution more widely than remotest areas.



IPSTAR has a number of proposals, which it believes can lead to optimum and overall reduced subsidy levels.

IPSTAR is in the very early stages of a large deployment. The satellite covers an area from India through to Japan, including China and South-East Asia, in addition to Australia and New Zealand. IPSTAR expects to deploy over 2 million of terminals across the coverage area, and in the near future will begin to achieve substantial economies of scale.

IPSTAR believe that Connect Australia can allow IPSTAR to achieve some immediate economies of scale.

3.1 Customer Terminals

IPSTAR expects to deploy over 2 million of terminals across the coverage area and manufacturing partners advise that substantial savings in terminal cost can be expected as economies of scale are reached. However at this early stage, manufacturing scale is more limited.

By underwriting a volume purchase of Customer Terminals to be deployed in Australia, and allowing IPSTAR to make forward orders, the Broadband Connect program can achieve economies of scale now - which will lead to a direct reduction in the overall subsidy per service.

Into the future the natural economies of scale from the pan Asian IPSTAR deployment should bring opportunities for ongoing movement in the service to lessen the likelihood of a growing gap with the expected lowering of prices for terrestrial broadband.

As part of the ongoing development cycle in IPSTAR, additional terminal configurations will be deployed. In addition to the Professional Terminal currently in service, a lower cost Consumer series and a higher specification Enterprise terminal are currently being prepared prior to release.

3.2 Backhaul

When the IPSTAR Satellite was designed, one of the constraints was that it was necessary to place the ground gateways for Australia outside the Spot Beams. The areas selected were Kalgoorlie and Broken Hill due to the minimum requirements of backhaul that each location had.

These locations have advantages in that IPSTAR has made significant investments in infrastructure in these remote locations in Australia. They



create local employment and utilize regional radio spectrum in contrast to over utilized spectrum in metro areas. These locations also benefit the overall network availability due to minimal rain fade conditions at the gateway.

However the price of backhaul capacity to capital city PoPs has been a negative issue. This backhaul has added over 60% to the bandwidth airtime price to Service Providers.

Hence IPSTAR proposes that investment within the framework of the Broadband Connect Program by underwriting the cost of the backhaul will benefit Service Providers and regional Broadband Connect customers by allowing IPSTAR to reduce the price of Airtime significantly from its current levels. This in turn will result in the subsidy per user being able to be reduced.

IPSTAR believes that investment in terrestrial connections for IPSTAR gateway locations has the additional benefit of efficiency in the Connect Australia program, particularly Clever Networks, but also Mobile Connect and Backing Indigenous Ability. Provision of capacity to IPSTAR may result in ability to leverage more economic infrastructure links to local wireless and mobile tower locations. Rather than investment in a plethora of local links, services to the gateway sites provide the ability to distribute capacity to any location nationally, rather than just have a local benefit.

Further IPSTAR believes that development of additional fibre capacity to Broken Hill by way of path diversity not only benefits reliability of services for both IPSTAR end users and Broken Hill itself, but also has the potential to open up new competition in the development corridor.

4 MINIMUM SERVICE LEVELS, SCALABILITY AND APPLICATION SUPPORT

Broadband Connect will, for most users, be a one off opportunity to take up a broadband service. Given this, it seems critical that the service provided has performance, scalability and application support to be viable for some time into the future. The scheme should provide a degree of “future proofing”, not create the likelihood of islands of future disadvantage.

IPSTAR believes that 256kb/s download, 64kb/s upload is no longer an acceptable broadband benchmark.

IPSTAR proposes that the absolute minimum service to be eligible for a government subsidy is 512/128 with 500Mbytes data per month. This is



necessary if users are to be able to access typical applications being utilized by broadband users in metro areas.

It is evident from the marketplace that connection speeds in metro areas are increasing. To minimize future disadvantage IPSTAR proposes that all services eligible for subsidy must be upgradeable, without the need for a site visit, to a minimum of 2Mbps/512kbps.

The volume of usage is also clearly increasing among broadband users. Again, if some future proofing is to be provided for out of Broadband Connect, the services should be scalable to allow for growth in volume of use. IPSTAR proposes that all networks should be able to be viably scaled to allow for growth in data usage such that each user could upgrade to plans providing 5Gbytes of upload/download per user per month.

Use of VoIP is growing among broadband customers, and IPSTAR believes VoIP will increasingly be used in substitution of fixed line services to lower the cost of communications. To provide equity, regional Australians should not be left behind in relation to VoIP.

It is critical that any broadband services eligible for subsidy should inherently support and optimize VoIP. Quality of Service benchmarks should be established by Broadband Connect in relation jitter and voice quality standards. Benchmarks for latency should directly reflect what is an acceptable quality for the end user experience.

IPSTAR also expect that users in remote areas will, in future, make increasing use of applications such as videoconferencing to improve delivery of services such as education, medical advice and to improve the quality of access to agencies and service businesses. The upgradeability and scalability proposed above is critical to allowing users to adopt such applications as service delivery agencies develop the capability.

IPSTAR believes the current performance measurement methodology should be maintained.

5 COMPETITION ISSUES

IPSTAR is a new entrant in the Australian market, and we believe IPSTARs participation is critical to the Government's objectives for services in rural and remote Australia.

IPSTAR needs significant volume of takeup to remain viable and to grow and improve as technology improves and customer usage patterns evolve. Broadband Connect has the potential to promote significant demand for satellite broadband, but it also will support competitive technologies, which



will diminish the satellite addressable market. Of particular concern is the potential to invest in otherwise uneconomic terrestrial connections to local broadband wireless locations. These not only have the potential to “pick the eyes” from the satellite addressable broadband market, but also many of these links could be more economically delivered by providing IPSTAR broadband direct to the wireless site and would underpin the system viability except for distortion of the market through the Government subsidy.

IPSTAR proposes that all applications for subsidy should be evaluated to choose the most economic technology to deliver the end user requirement, not necessarily accepting the particular technology incorporated by the proponent. Competing technologies and services should be able to demonstrate economies of scale and scalability which will result in broadband services being delivered at equitable prices to metropolitan areas, while still being able to reduce the overall subsidy per service deployed.

IPSTAR believe the current cap on subsidy per service provider of 60% is too high. It has been argued that given the increased competition which developed under HiBIS, it is unlikely that any Service Provider would approach 60% in any case, so there is no need to make a change. IPSTAR disagrees strongly. The quantum of subsidy accessible under Broadband Connect is much larger, so 60% of the pool is a very large amount, and higher than should be available to any individual Service Provider. And if it is “unlikely” that any Service Provider would achieve 60% share, then there is no need to maintain that provision.

IPSTAR proposes the limit for an individual Service Provider be set at 40%.

6 SUMMARY

IPSTAR is a next generation satellite broadband system uniquely required to deliver performance and scalability to meet a critical requirement for Broadband Connect: the need to deliver equitable broadband to all Australians.

While Shin Satellite has made a substantial investment to make the broadband satellite infrastructure available over Australia, Broadband Connect can promote economies of scale, and achieve lower end user subsidies by:

- underwriting an upfront order for User Terminals to secure a lower terminal cost to Service Providers
- underwriting the backhaul cost from the regional gateway locations in Broken Hill and Kalgoorlie.

IPSTAR has a roadmap to secure ongoing economies of scale which will serve to lessen any ongoing gap as metro broadband service costs fall.

IPSTAR proposes the minimum service eligible for subsidy should:

- Have a minimum speed of 512/256kb/s and 500Mb/mth of data
- Be upgradable without the need for a field visit to at least 2Mb/s/512kb/s to provide for future proofing
- Have a credible network design which allows for all users to scale up their usage to 5Gb/mth, again to provide some future proofing
- inherently support and optimize VoIP, and be at least able to be upgraded to allow for quality videoconferencing

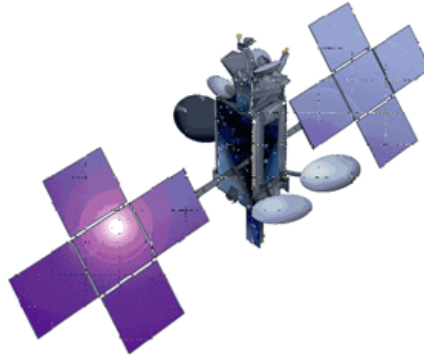
IPSTAR is concerned about aspects of Connect Australia that may result in distorted investments, which may harm the ability of IPSTAR to achieve economies of scale.

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Key features of IPSTAR

6.1 Space Technology : IPSTAR-1 Satellite



Key Technology Features

Spot Beam Coverage:

Traditional satellite technology utilizes a broad single beam to cover entire continents and regions. With the introduction of multiple narrowly focused spot beams and frequency reuse, IPSTAR is now capable of maximizing the available frequency for transmissions. Increasing bandwidth 20 times more than traditional Ku-band satellites translates into a more efficient satellite. Despite the higher costs associated with spot beam technology, the overall cost per circuit will be much lower than existing shaped beam satellites.

Dynamic Power Allocation: This new technology optimizes the use of power among beams and allocates a power reserve of 20% to be allocated to beams that may be affected by rain fade, thus maintaining the link. Given the vast geographical coverage of the Satellite, it is unlikely that rain would fall simultaneously across the entire region; therefore this dynamic allocation of power only to beams in need is a very effective way to increase IPSTAR System's overall high link availability and reliability.

Spacecraft Configuration	Description and Approximate Capacity
Spacecraft	<ul style="list-style-type: none"> • Geo-stationary satellite with Bent Pipe payload configuration (no on-board processing to avoid the obsolescence of processing technology which develops at a remarkable speed, no inter-satellite link) • 12 years life • 15 kW power
Orbital Slot	<ul style="list-style-type: none"> • Located at 120 +/- 0.5 ° East • Additional satellite for co-location or different slot in the future
Total Digital Bandwidth Capacity	<ul style="list-style-type: none"> • 45 Gbps of Spot Beam aggregate capacity at 84-120 cm. Dish • Equivalent to 1,000+ Transponders of 36 MHz of conventional

Ku Beams
Ka Beams

- 84 Spot beams, 3 Shaped beams, 7 Regional Broadcast beams
- 18 Feeder beams and Gateways

Beam and coverage

IPSTAR-1 is a regional satellite system, whose beams will cover 22 countries throughout the Asia-Pacific Rim, with Ku-Band (84 Spot Beams, 3 Shaped Beams, and 7 Regional Broadcast Beams) and Ka-Band (18 Feeder Beams & Gateways).



6.2 Ground Technology (Ground System)

6.2.1 Terminal, Gateway, and Network Configurations

IPSTAR user terminal is a low-cost, flexible and high performance two-way satellite terminal that works in conjunction with IPSTAR as well as any conventional Satellite and the IPSTAR Gateway. Air interface employing advanced waveforms on forward and return channels are optimized for the overall system efficiency.



The waveform for forward channel is based on TDM-OFDM technology that utilizes bandwidth and power more efficiently. The forward channel is optimized to accommodate multiple data rates, a variable number of users of different modulation formats and forward error correction coding. On the other hand, for the return channel is based on MF-TDMA



technology for bursty traffic and dedicated allocation for high data rate applications.

The waveform is fixed to a more robust modulation to ensure link-availability at low transmission power. However, if higher transmission bit rates are required, the return channel can be configured to dedicated allocation behaving like a SCPC-Like (pre-assigned TDMA) channel that can support higher transmit data rates up to 4.0 Mbps at the expense of required additional transmit power from the user terminal.

6.2.2 Key Technology Features

- **Dynamic Bandwidth Management:** Because satellite links will always have less theoretical bandwidth than optical fiber links, efficient bandwidth management techniques are required to maintain the competitiveness of broadband satellite systems. A network control center will be used to allocate bandwidth capacity to each connection according to current traffic characteristics, network congestion, link conditions and user requirements. This technology will adjust bandwidth dynamically (modulation and coding) to suit changes in weather conditions, thus maintaining very high link availability. Since it will be used on the ground, it is upgradeable in the future if required.
- **New Coding and Modulation Technique:** IPSTAR's modulation and coding technologies provide for efficient use of radio frequency bandwidth which allows for high and flexible digital transmission rates. This system allows for the use of small antennas and transmitters suitable for home and corporate use and can maintain up to 99.6% link-availability rate. The Modulation and Coding (link parameters) can be adjusted dynamically, resulting in dynamic bandwidth capacity to optimize the trade-off between bit-rate and sudden changes in weather condition (such as rain).

6.2.3 User Terminal and Gateway

The terminal and gateway incorporate the proprietary modulation and coding technologies, and transmission architecture optimized for the IPSTAR satellite system. The interface for the terminal and gateway to any device or network will be based on the industry standard Internet Protocol, to ensure a seamless integration to the existing system, software, hardware, applications, services and networks. SSA expects the larger volume productions and more advanced chip integration to bring down the cost due to economies of scale. Furthermore, different form factors and IDU models will be introduced to the market.


Products			
Model	IPX-5100 Professional Series	IPX-3100 Consumer Series	IPX-9200 Enterprise Series
Support Protocols	UDP/TCP/IP including TCP Enhancements	UDP/TCP/IP including TCP Enhancements	UDP/TCP/IP including TCP Enhancements
Transmit Data Rate	Up to 2 Mbps	Up to 512 Kbps	Up to 2 Mbps
Receive Data Rate	Up to 4 Mbps	Up to 1 Mbps	Up to 4 Mbps
Modulation	QPSK, 8-PSK Modulation	QPSK, 8-PSK, 8-PAH Modulation	QPSK, 8-PSK, 8-PAH Modulation
DLL Support	Yes	Yes	Yes
Status	Power on/off, LAN Link, Ethernet Activity, Sync Status	Power on/off, LAN Link, Ethernet Activity, Sync Status	Power on/off, LAN Link, Ethernet Activity, Sync Status
Dimension	230 x 270 x 75 mm/ 1.7 Kgs	<i>TBC</i>	<i>TBC</i>
Form Factor	Standalone /Compact	Standalone /Compact	19" standard industrial rack
Network Interface	10/100 Mbps Ethernet (RJ-45) / USB 2.0	10/100 Mbps Ethernet (RJ-45)	10/100 Mbps Ethernet (nRJ-45)
DC Power Supply	Optional (-12V) for rural applications	Optional (-12V) for rural applications	Optional (-12V) for rural applications
Availability	Now	Q3' 2006	Q1'2006

Figure 3.1: IPSTAR User Terminal Products

The IPSTAR network configuration is based on Gateway STAR topology. A user terminal will receive and transmit signals from/to a Beam, which connects with a gateway. The gateway in turn connects to other networks such as the Internet backbone, telephone network and corporate.



home users.

IPSTAR's Modulation and Coding technology provides an efficient use of RF power and bandwidth, allowing a high and flexible digital transmission rate which allows the use of small antennas and transmitters. The various form factors of IPSTAR's user terminal include Enterprise Series and Professional Series for individual

