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HD Video Teleconferencing via Satellite Broadband

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HD video teleconferencing (HD VTC) can be implemented equally well over satellite or terrestrial broadband networks. Satellite has successfully carried video teleconferencing (VTC) in many forms for at least thirty years. Television news and current affairs shows often include remote guests who are interviewed 'live via satellite.' What has changed is the movement of VTC from a telecommunications service to an Internet Protocol service, and the opportunities that creates especially for low cost consumer usage. Modern engineered IP networks are designed to accommodate the specific technical requirements of HD VTC, resulting in comparable user experiences regardless of the underlying network technology.

From the perspective of VTC, modern broadband satellites are essentially IP links with a given latency. This latency is not a significant impediment to practical use as both visual and audio cues allow the users of satellite VTC systems to easily synchronise their interactions. Most people are familiar with this from their exposure to television news.

From a satellite broadband perspective, VTC traffic has two main characteristics that distinguish it from most other traffic. The first is the symmetric nature of the bandwidth required to support VTC, and the second is the low tolerance to jitter. Modern satellite broadband systems accommodate these requirements firstly by ensuring that return channels (the link from the subscriber to the gateway) have sufficient capacity to support the VTC session, and secondly through the use of standard Quality of Service (QoS) management techniques to ensure bandwidth stability and quality.

As the bandwidth available for VTC has increased, so has the quality of VTC services. Early affordable commercial VTC systems made use of telecommunications services such as ISDN. These services provided very low picture resolution and slow refresh rates coupled with sound quality that could be described as 'adequate'. Typically 64 kbps carried the voice circuit and an additional 64 kbps was allocated to the picture. PictureTel was an example of a successful equipment provider. Military users around the world successfully deployed these systems across relatively low capacity satellite links (256 kbps symmetric) in the mid-90s. While these systems were 'taskworthy', they did not succeed in the general marketplace (either terrestrially or over satellite) because the picture quality was too poor and the refresh rate was too slow. Rapid reductions in the cost of bandwidth coupled with rapid increases in processing power have significantly improved the quality of the experience and therefore the appeal of VTC, and made it desirable for the home subscriber.

The amount of capacity required by VTC depends on the quality of the picture (in particular the resolution of the picture and the refresh rate) and sound. Significant work has occurred on compression and coding schemes for both picture and sound, leading to improved quality with lower bandwidth requirements. As a result, a number of different VTC solutions have evolved, with the distinction between them being mostly a matter of degree. These solutions can be divided into soft client solutions, video teleconferencing, and telepresence. These solutions are compared in

Table 1.

Table 1. VTC Services Categorized

Type of Service	Description	Typical Picture Resolution and Refresh Rate	Audio	Symmetric Data Requirement	Notes
Soft Client	PC/ Webcam: - Skype - CU-SeeMe	320x240 30 Hz	PC Microphone	~250 kbps	<ul style="list-style-type: none"> • Typically proprietary protocol. • Typical point-to-point only.
Video Teleconferencing	Dedicated System, single user/small room: - Polycom - Tanberg	1280 x 720 30 Hz	Dedicated microphones and speakers	2 Mbps to establish. 1 Mbps to maintain.	<ul style="list-style-type: none"> • UTI standards. • Multi-point options available.
Telepresence	Dedicated facility: - Cisco - Polycom - Tanberg	Multiple 1280 x 720 30 Hz or greater	Dedicated fixed speaker and microphone system	Up to 4 MHz to establish, per screen. 1 Mbps per screen sustained.	<ul style="list-style-type: none"> • UTI standards. • Multi-point options available. • Dedicated telepresence facilities.

Modern 3rd generation Ka-Band satellite broadband services can easily provide 2 Mbps of return capacity (that is throughput from the subscriber back over the satellite into the gateway), and 12 Mbps of forward capacity. From a bandwidth perspective, these satellite broadband systems are capable of supporting High Definition point-to-point VTC using the home HD television as the display device. In order for satellite broadband home users to participate in multi-point HD VTC, they will likely need to purchase higher end services (>2Mbps) that might require a higher power CPE, including larger amplifiers or dishes, and multiple HD televisions. Multipoint Standard Definition VTC (for instance multiple split screens on the standard home HD television) is easily achievable with standard service levels and user equipment.

In addition to quantity of bandwidth, a VTC experience is dependent on the *quality* of the bandwidth. The impact of jitter on VTC services can be severe. While VTC is intolerant of variations in latency, this is not a problem for modern broadband satellite systems. The QoS inherent in modern satellite broadband systems allows bandwidth of particular quality and quantity to be allocated to specific applications allowing for very stable service delivery even during whether events or times of high congestion.

From the perspective of QoS management, VTC has evolved along two main paths, these being services that conform to international standards and those that don't. This presents a problem for QoS in engineered IP networks in general (both terrestrial and satellite). QoS systems detect and prioritise traffic based on its conformance to specific standards. This is why home VoIP solutions

based on Analogue Telephone Adaptors (ATA) making use of standard protocols often provide far better service than computer client softphones. The ATA solution conforms to international standards and therefore can be prioritised by the network. Many softphones, the classic example being Skype, employ proprietary protocols that are not recognised natively by QoS systems. As a consequence these softphone services are not given the prioritisation they require for high quality performance.

Satellite broadband systems are like all other engineered IP-based networks. At times of low contention the excess resources generally mean that services based on proprietary protocols (including VTC services) will operate well. At times of high contention the QoS will not recognise (and therefore will not prioritise) these as VTC services, leading them to be amongst the first to degrade. However, since proprietary VTC services are generally confined to low resolution and therefore low data rates, they are often able to provide satisfactory service even during degradation, and since they are generally free, users tend to be more tolerant of lower performance.

Higher quality services, and increasingly some soft client solutions, make use of International Telecommunications Union (ITU) or Internet Engineering Task Force (IETF) standards. H.323 is the prevalent ITU standard while Session Initiation Protocol (SIP) is the dominant IETF standard. Traffic conforming to these standards is easily recognised and prioritised by QoS, providing high quality, stable services across satellite links, and indeed any contended IP network.

The uptake of soft client, non-standards based VTC by residential users and some small business users has been very rapid amongst terrestrial broadband subscribers, especially on the back of the service launched by Skype in January 2006. Unfortunately, there is no evidence of any VTC take up amongst satellite broadband subscribers today. This is because the service plans offered by existing satellite broadband providers are simply incapable of supporting the bandwidth required for VTC. There are, however, non-commercial examples of successful satellite VTC implementation in Australian homes today. Two prominent government funded examples are the multicast point-to-point distance learning services offered by the Northern Territory and the School of the Air. In these services high quality video is distributed to students, with a lower quality selective return service controlled by the teacher. The student sees the teacher clearly, the teacher is provided with thumbnails of the students. These services are a taste of what would be possible with the capacity and price points offered by 3rd generation Ka-Band satellites. It is easy to draw a line through these initial government funded initiatives to remote health care, remote legal services, distance education, promotion of tree-change professionals, and enhanced communications with family and friends.

In conclusion, Satellite broadband networks are engineered IP networks that provide comparable services to terrestrial networks. In particular they offer all the Quality of Service features found in modern terrestrial IP networks. VTC has been successfully employed across satellite for many years. The transition of VTC from traditional data to IP services posed as many challenges for satellite as it did to terrestrial systems. In the consumer space these challenges have largely been overcome, offering the prospect of affordable, high quality VTC to users regardless of their physical location.