

KaComm Communications Pty Ltd

IPTV via Satellite

9 September 2009

Satellite is ideally suited to the delivery of broadcast television services. The overwhelming strength of satellite is the ability to cheaply deliver vast amounts of content to millions of subscribers simultaneously. Satellite has some constraints in the delivery of customised one-to-one services, although third generation broadband satellites can support 60 Gbps and more of forward capacity and can reach the most remote users. By combining satellite distribution with appropriate set-top-box (STB) technology a competitive, fully featured IPTV service comparable in nearly all respects with mature wired services can be delivered to a widely dispersed audience.

IPTV is conventionally divided into two major classes of services, these being scheduled (linear content) and video on demand (VOD). When considering the satellite delivery of IPTV it is more useful to divide content into 'live' and 'cached' classifications. Live content is produced and distributed in real time; for example sporting events and news. Cached content, as the name suggests, is stored before being distributed. Cached content may be distributed as VOD or as 'scheduled' content in the sense it is quarantined until a predetermined release date. DirecTV in the US and FoxTel IQ in Australia currently provide these types of services over satellite for sporting events, traditional television programming and 'movie club' type services, and require only that the consumer has the appropriate STB.

The existing pay TV market already demonstrates the strength of satellite in the live distribution space. From the perspective of the subscriber, the only difference between satellite cached services and what might be possible under a fully deployed NBN is the range of services. However, three trends suggest that for the vast majority of subscribers this will not be a problem. These trends are:

- The 'docking' of the long tail
- The decreasing cost of hard drive storage
- The increasing capacity of broadband satellites

A seminal work, 'The Long Tail' by Chris Anderson in October 2004 *Wired* magazine¹ (and subsequent book) suggested that the reduced cost of distribution facilitated by the Internet would enable service providers to satisfy the supposed demand for rarely accessed content. Subsequent studies of Rhapsody and Quickflix data² have called the long tail into question, noting that most sales cluster around the most popular items, and, if anything, the Internet appears to be increasingly concentrating sales around blockbusters. (Similar affects have been noted in the referencing of academic papers, where studies suggest that since academic works have been put

¹ <http://www.wired.com/wired/archive/12.10/tail.html>

² Anita Elberse of Harvard Business School
http://conversationstarter.hbsp.com/2008/07/the_long_tail_debate_a_respons.html

on line the number of highly referenced works has reduced rather than increased³.) This behaviour was also noted by the CEO of DirecTV at the Satellite 2009 conference⁴ when he stated that in the experience of his company most people consumed the top 1000, be this movies, television, You-Tube clips, Hulu downloads, or audio, and that it has proved possible to accurately predict the evolving top 1000 based on interpolation of instantaneous consumption patterns.

At the same time, the cost of hard drive space is falling rapidly. Anecdotally, hard drive capacity doubles every two years for no change in price. Currently 1 TB of external USB-accessible storage, sufficient to store around 120 full length feature films in standard definition, is available from Harris Technology for \$149⁵ retail. The price at the factory door in China is likely to be one tenth of rrp. By the time KaComm-1 launches it is likely this capacity will have quadrupled (i.e., doubled twice), allowing storage of nearly 500⁶ full length feature films on a single drive. Shortly after launch this may increase to over 1,000 movies in standard definition (approximately 50 Blu-Ray HD movies) with no increase in cost.

In the current KaComm system design the lowest capacity spot beams (for instance servicing the Tanami Dessert) still support in excess of 375 Mbps forward capacity, enough to download a full length SD feature film in approximately twenty seconds, or over 1500 standard definition films (60 Blu-Ray HD films) per night during the quiet period between 11:00 pm and 7:00 am. VSAT CPE available today, for instance the Hughes Network Systems NX range of Ku-Band equipment, is able to receive streaming media (UDP) at 45 Mbps – substantially more capability than that required for High Definition live media. Manufacturers have road-mapped significant increases in this capacity over the next four years.

Coupling high capacity broadband satellites with modern STBs will for all intents and purposes negate the difference between satellite and NBN delivered cached content for all but the most extreme long tail outliers. Interestingly, contention combined with QoS actually works in favour of consumption of obscure live media. Modern satellite QoS allocates bandwidth on demand. As more subscribers access media it is allocated more resources, therefore improving the quality of reception. It is not difficult to image an algorithm that automatically caches media to the STB as it becomes more popular with the subscriber base. In this model, the first few consumers take the media live from the source while the remainder receive the service cached from their STB. This approach would also work for time-shifted live content that was not predicted to feature in the head-end of the long tail, and therefore not cached automatically.

³ James Evens of University of Chicago <http://www.sciencemag.org/cgi/content/abstract/321/5887/395>

⁴ Conference Proceedings Satellite 2009

⁵ <http://harristechnology.com/part/V5363-LaCie-Hard-Disk-Design-by-Neil-Poulton-Hard-drive-1-TB-external-Hi-Speed-USB-buffer-16-MB/detail.htm>

⁶ For this paper a Standard Definition full length feature film is assumed to consume 800 MB, a Blu-Ray High Definition equivalent is assumed to consume 22 GB.

The key architectural issue concerning the incorporation of IPTV into satellite broadband is the choice of either 'out-of-band' or 'in-band' distribution. In this context, out-of-band refers to establishing a separate broadcast type service specifically for the distribution of IPTV content, whether live or cached. In-band refers to distributing the content over the same carriers used to distribute normal Internet traffic. Modern QoS allows for both, but the choice influences the design of the system, in particular the beam pattern and spectral and power efficiency of the overall system. Depending on programming choices, out-of-band may either waste capacity during periods of low user demand (early in the morning), or provide an efficient medium for the distribution of cached content for the next day's or week's programming.

The KaComm system design is well equipped to support either approach. For an out-of-band service KaComm has obtained from the ITU 600 MHz of broadcast spectrum capable of delivering one full standard definition movie to every one of the 11,000,000 premises on the Australian mainland and Tasmania every *five* seconds (i.e., 17,000 movies per day). Of course, the delivery of a Blu-Ray High Definition movie takes longer, but even for an FTTP user with a fully dedicated, un-contended 100 Mbps fibre service a 22 GB HD movie will take approximately 30 minutes to download, while for the KaComm broadcast service this could be achieved in less than 3 minutes. KaComm could easily distribute over 180 Blu-Ray HD movies between 11:00pm and 7:00am every night.

The preferred approach might be combining both the in-band and out-of-band techniques to produce a hybrid where the broadcast capability is deployed to support live HD IPTV (supporting up to 150 channels⁷) while cached content is delivered during the early morning by unused in-band capacity. Some caching of live content may occur to facilitate time-shifting. In total this idle in-band capacity is likely to approach 60 Gbps (sufficient to deliver the equivalent of three Blu-Ray HD movies every second) for many hours to the entire national population.

A significant advantage of IPTV is the ability to target advertisements to the specific geography or demographic of the subscriber. According to Cisco (briefing 1 July 2009 to KaComm) DirecTV generated US\$200m in advertising revenue in the last financial year while TimeWarner generated US\$1,000m, the difference being the ability of TimeWarner to customise its advertisements for the location of the subscriber. Both cached content and live streaming through spot beams via satellite will support the insertion of localised commercial content with the appropriate STB. This cached/live content approach is even supported by some analysts for the terrestrial network as reported in the *Financial Times*⁸ on 31 August 09.

One feature of some IPTV implementations that will be more difficult to fully support over satellite is true Network-Digital Video Record (N-DVR) capability where the media is recorded for later instantaneous consumption in the home. While there is a large amount of bandwidth available in third generation satellite broadband systems, supporting tens of thousands of individual HD services simultaneously is infeasible. N-DVR for consumption out of the home – on

⁷ This paper assumes that a HD channel encoded by MPEG-4 and delivered over DVB-S2 consumes 8 Mbps.

⁸ <http://www.ft.com/cms/s/0/f3bcf4c2-9649-11de-84d1-00144feabdc0.html>

mobile devices etc – is quite feasible as this will not unnecessarily burden the large but ultimately finite capacity of the broadband satellite. N-DVR taking advantage of afterhours caching to the STB is also a possibility. There is sufficient return capacity to support some SD DVR distribution services from the home; for instance streaming media from the DVR to a mobile device outside the home. It is unlikely that live streaming of HD content from the home DVR to devices on terrestrial networks would be possible except for highest end services.

Finally, a practical consideration is the ability to distribute IPTV around the subscriber's home. A source of considerable cost in FiOS type deployments is actually distributing the IPTV signal from the Optical Network Terminal (ONT) to the television. FiOS addresses this issue by making use of MoCA to distribute a 'blended' type service across coaxial cable. Given the high penetration of cable television in the United States this probably makes sense, but is probably not a suitable solution for Australia where coaxial cable, if deployed, will be to traditional free-to-air antennas on the roof. Satellite Pay TV currently utilises an STB, literally a box that sits on the television set. Given that the major in-home problem associated with IPTV is distributing the IPTV feed to the television, it may make more sense to terminate at the television. Data can easily be shipped from the STB to home computer users cheaply by traditional WiFi. Current terrestrial IPTV systems approach the problem in reverse. The most fault tolerant part of the system (the Internet connection) is delivered to the study, leaving the most fault intolerant part of the system (the IPTV link) to be cobbled together within the confines of the existing house. Delivering by satellite to an STB may significantly reduce the cost and effort of each consumer's installation.

In conclusion, a satellite broadband system offers considerable promise for the delivery of IPTV content. Third generation broadband satellites enable the cheap, simultaneous delivery of many channels of live HD content. When coupled with appropriate STB technology, rapidly rising storage capability, and idle in-band capacity, rich cached non-linear content along with customised advertisements can be more easily delivered to subscriber's homes by satellite than terrestrially. Additionally, focusing delivery of services on the STB rather than modem significantly reduces IPTV distribution issues within the subscriber's home itself.

KaComm has kept an eye on the future as it has developed its system design. The KaComm system has been engineered to enable the early delivery of rich IPTV content to all Australians, in harmony with more traditional Internet and voice services.