Community Broadband: Avonline Tooway Satellite Service Trial

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Summary

Satellite broadband services can locally provide stop-gap solutions pending the roll-out of the Community Broadband Scotland and Step Change 2015 projects. They can also provide in-fill coverage to properties that may remain beyond the cost-effective reach of current or forthcoming terrestrial solutions.

A pilot installation of Eutelsat's Tooway K_a band satellite broadband service, provided by Avonline, a Tooway reseller, has been operating in Balquhidder since September 2013. Installation and two month's service were provided by Avonline, with Two Worlds Consulting Ltd paying thereafter.

The system claims a performance of up to 20Mb/s download and 6Mb/s upload, subject to package-dependent usage capping and/or bandwidth throttling. Initial tests throughout Balquhidder Glen and Brig O'Turk demonstrated generally good coverage and a considerable improvement over previous satellite services.

Under most conditions, the trial installation has achieved 70% or better of the claimed bi-directional bandwidth. Uptime on the Tooway link over 134 elapsed days has been approximately 94%. Outages have been partly due to obvious weather conditions, predominantly in very heavy rain or during snowfall, although several outages remain unexplained. Latency (lag), an inherent characteristic of satellite services is typically around 770ms (compared to around 50ms for terrestrial ADSL), causing some problems with secure connections and with online gaming. Within the inherent limitations of satellite services, the system has proved largely effective.

As usage of the transponders that cover North and West Scotland increases, overall performance is likely to degrade. For a capped service where exceeding the cap can be costly or result in access being throttled, the current complete absence of any tools by which the subscriber can monitor usage is a critical omission.

Avonline's support for installation was poor and subsequent technical support has proven variable: some staff do not appear to possess or have access to basic requisite knowledge, often do not answer or return phone calls or emails. The standard of support provided by other Tooway resellers is unknown. There is no subscriber-accessible support ticketing system.

Despite generally good performance, the combination of inherent limitation of satellite-based (VSAT) internet connections and Avonline's occasionally marginal support means that this particular service can only be recommended if no effective alternative is available. The Tooway/Avonline contract provided does have a break clause in the event of superior terrestrial services becoming available, so its use as a stop-gap solution until the Step Change and CBS developments are complete is a practical consideration.

Satellite Provision to Loch Lomond & Trossachs

Satellite broadband services have hitherto had a bad press for reliability, especially during rain or snow, poor local sightline availability (given that we do have hills hereabouts), poor delivered throughput (as opposed to headline figures) and cost. The earlier government-contracted K_u band Avanti system and it's predecessors have and continue to suffer from all of these plus, in Avanti's case, an abysmal quality of support.

A new generation of service is however now available from the Eutelsat KA-SAT (via their subsidiary Tooway), a €400m new technology K_a band satellite which sits at 9°E, giving much of the local area a far better sight line than previous K_u band services. It also provides service via a total of 83 focussed spot beams, three of which cover most of Scotland (rather than a single beam as was the case with older satellites). Each spot beam has a throughput of around 475Mb/s and provides a service at up to 20Mb/s download and 6Mb/s upload.

In August and with the aid of Avonline broadband, a survey from a range of access points in Balquhidder Glen and Brig O'Turk was carried out, the outcome being shown in Figure 1 below[1].

Area	Site	Tooway
Balquhidder/Braes		**Availability**
	Balquhidder Village Hall	Y
	Monachyle Mhor	Y
	Inverlochlarig	Y
	Tulloch	Y
	Stronvar	Y
	Monachyle Tuarach	N
	Gart	Y
	Stronslaney	Y
Ballimore/Glen Buckie		
	Immeroin	Y
	Ballimore	Y
Loch Venachar/Loch Achray		
	Loch Achray (Loch Achray Hotel, Tigh Mor)	Y
	Brig o'Turk (community centre, post office & bungalows)	Y

Figure 1 – Tooway Service Availability

At one trial site (Stronslaney) the dish was pointing directly through fairly substantial trees and still managed a throughput of 13Mb/s. Other sites were showing 15-20Mb/s download and 4-6Mb/s upload.

[1] Monachyle Tuarach coverage was calculated rather than from an on-site survey.

Satellite is not however a panacea for local broadband provision, as the following all come into play, either as an inherent limitation of a satellite-based service or as a service limitation imposed by Tooway/Avonline. For each, general principles and the experience of the trial service are given:

Contention: Each of the 82 spot beams on the KA-SAT operates at 475Mb/s and each spot beam may ultimately need to support 10-12,000 subscribers. At full utilisation this would lead to significant slow-down in throughput at peak times. Current utilisation on the local spot beam[2] is believed to be around 25% and, whilst downlink speed does vary, on the trial it has not usually dropped below 14Mb/s, unless throttled under the Tooway/Avoline Fair Access Policy[3]. Figure 2 below shows KA-SAT spot beam coverage.

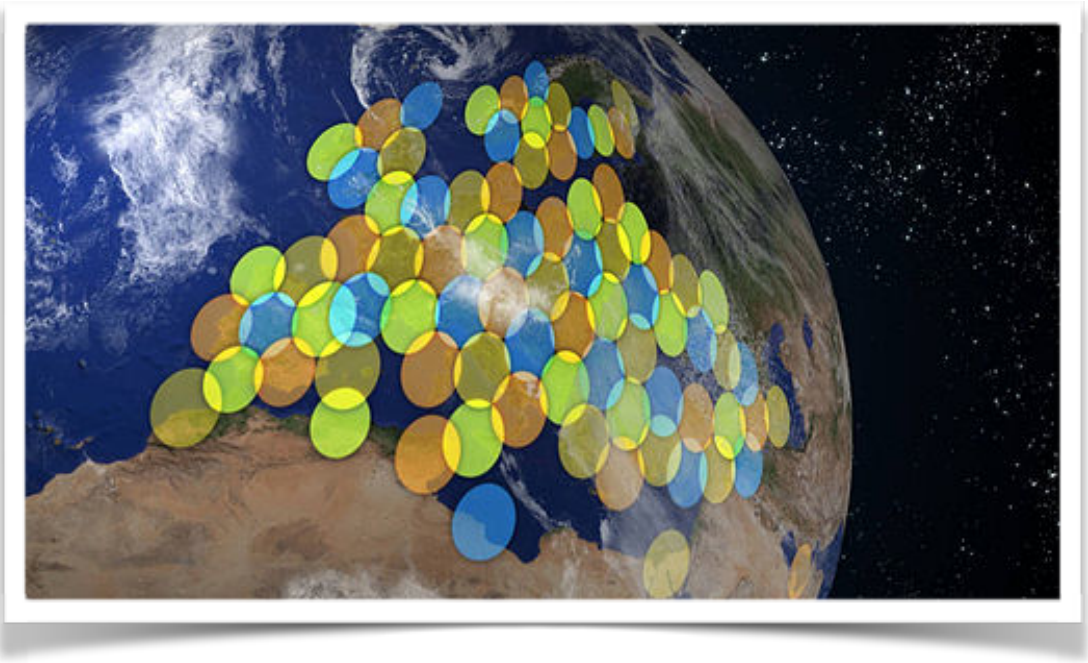

Figure 2 – KA-SAT spot beam coverage

Latency: Satellite services suffer from an inherent delay in transmission: part of this is the unavoidable light-speed delay of a 144,000km total round trip and the rest is encoding/decoding delay, which can be mitigated with better ground station equipment. Further testing is required for non-UDP connections i.e. corporate VPN connections. Measured Tooway latency is typically 750-790ms, of which roughly 480ms is transmission delay, with the rest being assumed due to proxying[4] and encoding/decoding overheads.

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[2] Most of the local area falls within an area of overlap of two spot beams so it is not entirely clear which is being enabled for local contracts.

[3] Because Tooway/Avonline do not provide usage tracking tools, it is not easy to tell whether lower throughput is down to throttling, contention, weather or issues with Tooway's ground network.

[4] Using an intermediate computer to 'pretend' that the service originates in the UK.

GeoIP: Some satellite services have had ground stations in the Netherlands or Italy, resulting in any service that is geographically locked to the UK being unavailable - BBC iPlayer being an example. iPlayer does work with Tooway, , apparently because, although there is no Tooway ground station in the UK, UK subscriber traffic is routed through a proxy server using a UK IP address. This approach may partly explain the latency figures seen on Tooway. The architecture of Tooway's network is not something that appears to be consistently understood by Avonline representatives - multiple different responses have been received from them. Working assumptions are therefore based on a network conference presentation given by a Tooway Director.

Reliability: In theory, K_a band is inherently more susceptible to weather interference, as it operates at a higher frequency than the older K_u band services. That however is balanced by better error correction techniques. In practice, raw uptime has been 91.37% between 11 September 2013 and 23 January 2014, corrected for outages due to power cuts. That does however understate the reliability of the Tooway service as the test site is configured with an automatic failover to standard ADSL and did not always automatically revert to the Tooway feed, requiring manual reconfiguration to do so. Allowing a reasonable estimate for time taken to manually revert, effective Tooway availability we estimate to have been a little in excess of 94% throughout the trial period.

Data Capping/Traffic Shaping: With Tooway, whilst a range of packages is offered, all are capped to a greater or lesser degree, at least during peak hours of 7am to 11pm. The trial uses the now-discontinued Tooway Absolute product, which applies a Fair Access Policy to usage, meaning that excess use can lead to bandwidth restrictions in peak hours. Other Tooway/Avonline packages are capped and will essentially stop (restricted to 256Kb/s download) once the limit is reached. Additional data packages can then be purchased. The most popular current Tooway service is their XXL product, which provides 50GB/month before being capped. This is usually fine for web browsing and email but heavy use of Youtube, iPlayer, video conferencing and the like will very rapidly use up this allowance.

Cost: Domestic packages are in the range of £25-£65/month. If you are a business that requires a fixed IP address, then costs are in the range from £72-£288/month for essentially similar bandwidth.

Avonline & Trial Installation/Configuration

Installation: This took place on a listed building, replacing an existing Sky satellite dish. In this case, the Sky receiver (LNB – the smaller of the two in the photograph) was mounted on an offset arm using the same satellite dish as the broadband connection. Avonline provide this as a £50 extra. This saved having to apply for additional listed building consent and having a second

dish on a historic building. The offset of the Sky LNB (which slightly degrades reception) is compensated for by the slightly larger size of the Tooway dish (72*68cm versus the 75*55cm dimensions of most Sky dishes), so Sky HD works very well under this arrangement.

Figure 3 – Tooway Satellite installation with additional Sky LNB

Installation at the trial site took two attempts: despite Avonline being forewarned (with photographs) that the installation would be on a chimney breast, replacing an existing dish, the installer did not have the correct equipment for the job and the Avonline H&S rules did not allow him to try the install. He returned a week later and, after a great deal of discussion, the installation finally proceeded.

It appears that Avonline only send out single installers rather than a team of two. Given that other local installations would be similar to the test site, it is entirely possible that these problems could arise again.

At the trial site, the single coax cable required to the dish for the Tooway service had already been installed, using copper coax cable. Such high quality coax cable is recommended for all such installations.

Configuration. The Ethernet connection from the supplied ViaSat modem was linked to the EWAN connection of a Bipac Billion 7800N Dual-WAN router. The ADSL port on the router was then configured as a failover connection, automatically switching over to standard ADSL in the event of failure of the Tooway service.

Service Types: Core web services, including email, web browsing, uploads/downloads and video/audio streaming perform well. Specific examples include:

- **Web browsing:** This is notably slower in response time than even a basic ADSL connection – there is a noticeable delay before anything loads, after which elements load in groups – a complex web page can take some time to load. This is unsurprising, given the high latency of any satellite service and the caching systems used by Tooway. Only those pages that contain large items of embedded content - large images, audio files, non-streamed video files etc - start to take advantage of the available bandwidth.
- **Skype:** This and similar services work very well, although of course generating considerable usage against the monthly allowance. Latency is very well controlled, with only a small delay apparent in conversations.
- **Secure Services:** Most secure (SSL) web services work well, although intermittent problems have been found with some banking sites. such as secure IMAP and SMTP connections to Google have proven problematic, due to connections timing out before they can be fully established. This however varies from device to device: iOS devices seem not to have any problem here.
- **VPN (Virtual Private Network):** These services vary: Two were tested: Private Tunnel connected reliably but throughput was highly erratic, typically providing <1Mb/s download and similar upload speeds. Bewhere's VPN service would connect but throughput was effectively zero. Further tests may determine how much of this is due to the satellite connection and how much to limitations of the VPN services.
- **Gaming**: Real-time gaming was not tested but it is safe to assume that any real-time game will effectively be unplayable, given the system latency.

[5] Réseaux IP Européens – the European regional internet registry

Monitoring: Uptime monitoring for the connection was provided by a RIPE[5] Atlas hardware monitor, reporting continuously to the RIPE Atlas database. All uptime calculations were taken from this database.

Support: During installation and usage, a number of calls and emails were made to Avonline technical support, with mixed results. Whilst they were able to provide some basic monitoring information, their level of technical and network knowledge has proven basic and inconsistent. At other times, calls and emails have simply gone unanswered. This, along with the lack of user-accessible monitoring and diagnostic tools, means that the overall support experience with Avonline has been marginal.

Links

Tooway: http://sat.tooway.co.uk. As of January 2014, Tooway lists seven resellers in the UK.

Avonline Broadband: http://www.avonlinebroadband.co.uk

Alignment Calculator: to work out dish alignment and help with sight line estimates, there is a useful calculator at: http://www.satsig.net/tooway/satellite-dish-pointing-ka-sat-tooway-europe.htm

Trial blog: Ongoing service comments and data are being provided at balquhidder.two-worlds.com.

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