

**The Problem:**

Police, military, public safety departments, and TV broadcasters all have a common need to share video and other high bandwidth data in real-time from remote locations. Public cell phone networks are often used for this purpose, but have proven unreliable during major events and crises. Critical operations call for the need to communicate without reliance upon the public infrastructure.

**MN-MIMO Mesh/Relay Solution:**

To address these challenges, Silvus proposes a 2 pronged approach:

1. **Strategic** - Fixed Silvus StreamCaster radios perched atop buildings, hills, towers, and other high points. These provide a backbone into which Tactical Radios can Mesh.
2. **Tactical** - Portable StreamCaster radios deployed as relays to penetrate into particularly remote or challenging areas and carry data out to the Strategic sites

This concept was demonstrated by Silvus and Amber Technology on Nov 18-19 in Canberra, Australia, with a 1W Radio carrying 40 Mbps over a 16 km distance, and acting as a relay in a 32 km link for HD video transport. Local mesh nodes were deployed to provide local coverage in built-up areas.

**The Demo**

StreamCaster radios are available in frequency ranges from 400 MHz to 6 GHz, with variable bandwidth of either 5 MHz or 20 MHz. For the purposes of this demo, the radios were operated in the unlicensed 2.4 GHz ISM band, with a bandwidth of 20 MHz. Radios were installed at 3 fixed locations

		
<p><b><u>Stromlo Forest Park (Pedestal)</u></b>                  Operation Centre (OC)                  4 x directional antennas. 2 x HPol, 2 x VPol.                  1W Silvus StreamCaster</p>	<p><b><u>National Arboretum</u></b>                  2 x Dual Input 4 dBi MultiPol Omni antennas.                  1W Silvus StreamCaster  <b>LOS Distance to Stromlo OC: 6 km. Relative Elevation 60m</b></p>	<p><b><u>Mount Ainslie lookout</u></b>                  4 x directional Antennas. 2 x HPol, 2 x VPol.                  1W Silvus StreamCaster  <b>LOS Distance to Stromlo OC: 16 km. Relative Elevation 220m</b></p>

Early tests from One Tree Hill to Stromlo via Arboretum (Total distance 25 kms) were successful, with operators actually logging in from San Diego, CA. and both viewing and controlling the PTZ camera from there. However access to the site was difficult and Mt. Ainslie was chosen for the majority of tests.

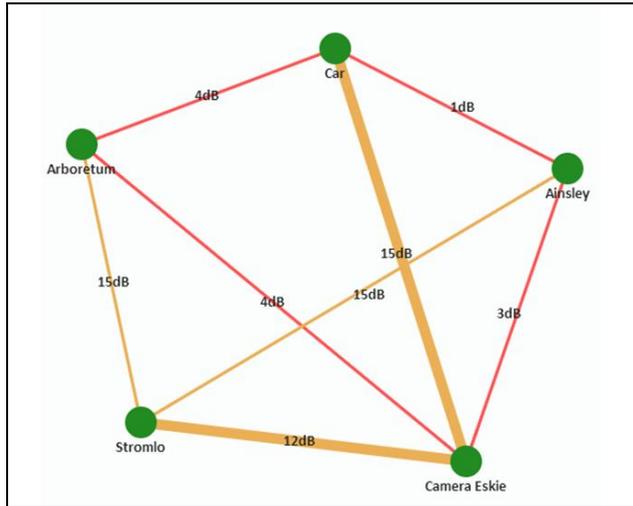
A 4<sup>th</sup> radio was installed on the roof of a vehicle with an HD camera and encoder. This was then used as a mobile transmit source to evaluate connectivity across the area. Video was also sourced from a PTZ camera at Mt. Ainslie and a fixed camera on a battery powered Relay Eskie that could be dropped anywhere. The output from these cameras was viewed in real time at Stromlo. A VOIP system was used for real time communications between Stromlo and Car across the mesh.

		
<p><b><u>Vehicle</u></b> 4 x 5 dBi VPol Omni antennas 1W Silvus StreamCaster</p>	<p><b><u>Camera Relay Eskie</u></b> 2 x Dual Input 4 dBi MultiPol Omni antennas. 1W Silvus StreamCaster</p>	<p><b><u>Stromlo Operations Centre</u></b></p>

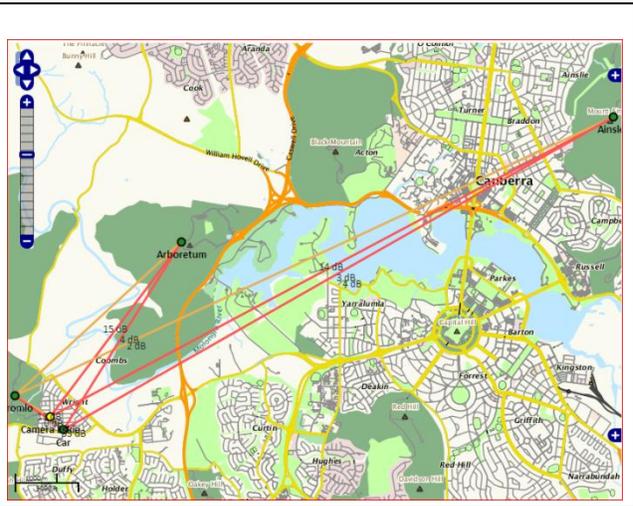
**Results**

Over most of the area between Stromlo and the Arboretum, the video was relayed either through Arboretum or Ainslie or went directly back to Stromlo. The routing handoffs were seamless and automatic. The radios decide what the most optimal path is, and no intervention is required from the operator.

There were however some particularly challenging areas deep in a suburban subdivision east of Stromlo where gaps in coverage existed due to extreme non-line-of-sight (NLOS) conditions (total masking of all 3 main sites by terrain and/or buildings). In these cases, the battery powered Camera Eskie was deployed on the side of the road to act as a relay for the Car. Upon power-up, the radio automatically joined the network and video from both the Car and Eskie cameras was visible at Stromlo. At all times the video from the Ainslie PTZ camera was available on a direct link.

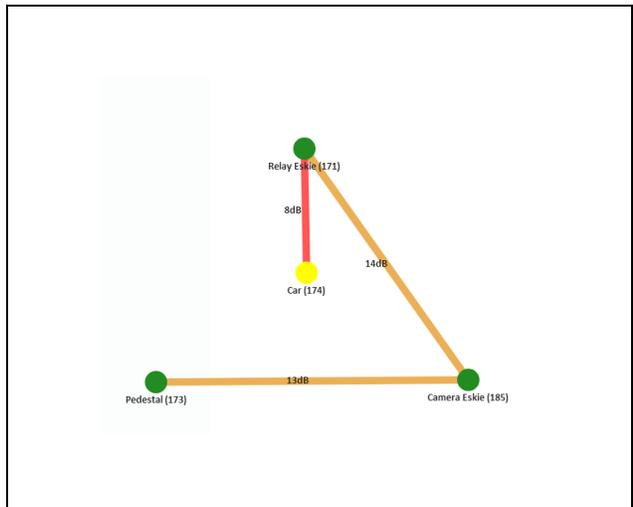


[StreamScape GUI](#) - Network Topology View of Car Camera relaying through Camera Eskie back to Stromlo

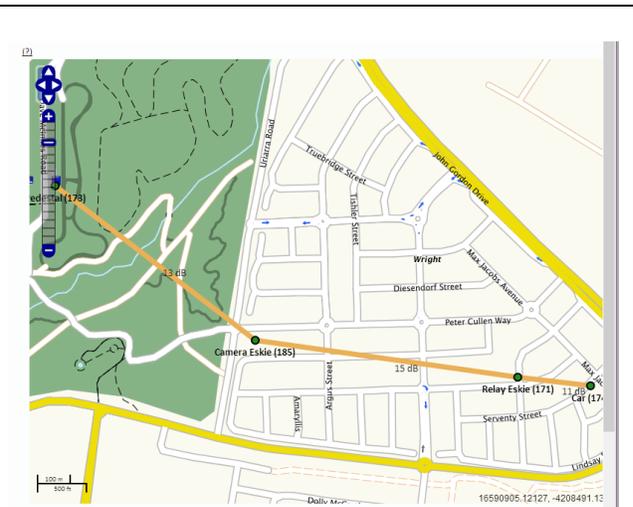


[StreamScape GUI](#) – Map Overlay View of scenario on left

A low level relay-only scenario was conducted by dropping 2 x battery powered Eskies to transport video back to OC at Stromlo without benefit of the elevated systems at Arboretum and Ainslie, which were turned off:

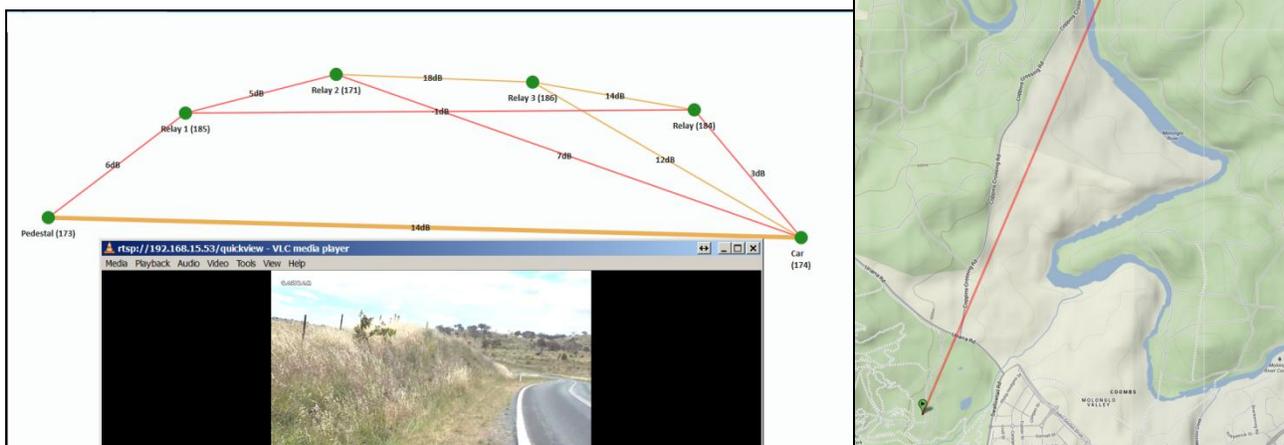


[StreamScape GUI](#) - Network Topology View of Car Camera relaying through a Relay Eskie and the Camera Eskie back to Stromlo



[StreamScape GUI](#) – Map Overlay View of scenario on left

As a final demonstration of Mesh Relaying techniques, a string of Radio Eskies equipped only with 2 dB Omnis was laid out at ground level to obtain coverage of a 6km length of twisty, hilly road section running out from Mt. Stromlo:



## Conclusion

These tests validate a novel approach for providing high bandwidth communications to mobile teams in a variety of challenging environments. By combining the strategic and tactical deployment of StreamCaster radios, it is possible to provide a flexible, private, and secure infrastructure which can be easily scaled and adapted to provide high data rate connectivity over large sprawling areas. As a measure of the capability of the StreamCaster radios, the data rate available from Mt. Ainslie to Stromlo OC using a 1W Radio was measured at 40 Mbps. When the Car was relaying through Mt. Ainslie back to Stromlo, its signal was travelling over a 32 km path. The system did not appear to be stressed and could clearly either carry more data (=more video and communications/data streams) or be stretched to significantly longer distances. These factors coupled with the inherent meshing/relaying characteristics of the system lead to some very powerful regional coverage capability, ideal for transmission of data feeds from a variety of applications.

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