

Case Study

Power Distribution Wireless Protection Relay Communications.

The Customer

Orion NZ Ltd owns and operates the electricity distribution network in central Canterbury between the Waimakariri and Rakaia rivers, and from the Canterbury coast to Arthur's Pass. Their network covers 8,000 square kilometers of diverse geography, including Christchurch city, Banks Peninsula, farming communities and high country.

They also own the electrical contracting business, Connetics and in turn are owned by:

- Christchurch City Council (89.3%)
- Selwyn District Council (10.7%).

Innovation and efficiency are hallmarks and their stated aim is to maximise use of assets and create value for shareholders while significantly contributing to the Canterbury economy and beyond.



The Challenge

Power distribution lines are typically protected by power line protection relays to ensure that even under severe fault conditions the line and equipment connected to that line is protected and that the impact of any power disruption is minimized.

Important attributes in designing a protection system are security, dependability, sensitivity and reliability. The protection network must trip when required and not trip on any false or external faults. Speed and reliability of protection are critical attributes.

Orion utilizes the latest GE L90 line current differential protection relays to provide this level of performance. Line differential relays compare the phase and timing of the current at each end of the transmission line to make almost real time judgments on line condition and fault status. The L90 uses communications channels of 64kb/s to communicate with each other and can detect a fault within a half a cycle plus channel delay. To achieve this, the L90 relies on precise distributed synchronization with clocks that are phase synchronized to each other.

For this reason very reliable communications channels with ultra low latency and phase jitter are very important attributes of the telecommunications medium that connects protection relays together.

Typically this is implemented with leased direct circuits or in some cases where available fibre optics. Microwave radio has also been used as either the primary or back up communications circuit.

The Solution

MiMOMax Wireless Ltd developed an “Optimised Protection Variant” (OPV) variant of its MiMO linking product family capable of supporting 128kb/s in a 25kHz wide radio band and operating on licensed channels for interference free reliable operation.

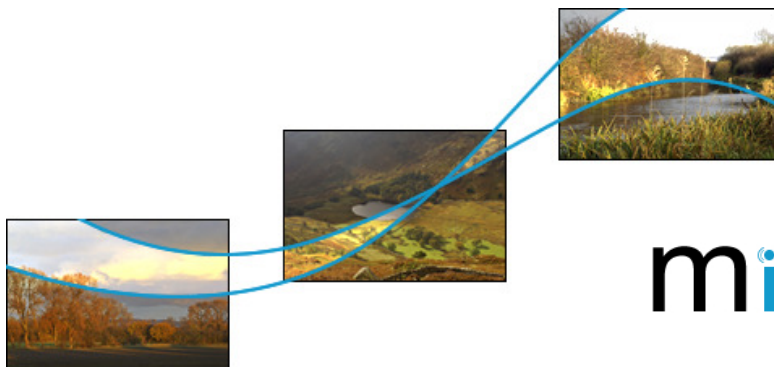
The OPV has a typical latency of 8mS so that three such links could be concatenated and the total latency still be inside two power cycles. Phase jitter on the synchronous data interface is less 55nS.

Utilizing the internal MUX the total data capacity is shared between the synchronous serial data interface and an Ethernet port which can be either used for SCADA or VoIP applications or connected to an external switch and further extended. Priority is always given to the synchronous interfaces. Alternatively multiple protection channels could be implemented on the one link.

The Benefits

MiMOMax technology gives Orion access to world leading spectral efficiency in a protected licensed interference free channel. The OPV is easy to set up, economical to implement and operate and connects directly to the L90. The 128kb/s capacity allows Orion to provide complete substation Protection, SCADA and Voice Communications over one radio link on one 25kHz channel.

Being 450 MHz MiMO means that the antennas are easy to align and not so badly affected by severe weather events such as ice and snow or minor path obstructions like some tree shading. The inherent MiMO diversity provides high reliability and excellent range-bandwidth product. The use of radio allows Orion to have control over the total protection solution including transmission medium and provides some insulation against inadvertent disruptions in the line caused by events outside of Orion’s control.



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