TMoIP - The Modern Replacement for Coaxial Matrix Switches

Technology Overview

Coaxial matrix switches have been a staple on telemetry ranges for years. They provided an electronically controllable alternative to the older manual patch panels. They come in a variety of sizes specified as “N” input ports by “M” output ports (i.e. 32 x 32) and blocking or non-blocking. Blocking allows only one input to be connected to one output. Non-blocking allows one input to be connected to multiple outputs. A front panel or software user interface allows the operator to make and break connections in the matrix.

Today, Telemetry over IP (TMoIP) is providing a modern alternative to matrix switching. TMoIP uses the inherent switching and distribution capability of Internet Protocol (IP) networks to route packets of telemetry data. Multicast transmission allows a single packet of data to be sent to multiple destinations providing unlimited non-blocking distribution of a telemetry stream. TMoIP also provides this capability over a large area, allowing remote sources of data to be switched to remote destinations.

Switching is handled in a distributed fashion by the routers and switches within the network infrastructure. This infrastructure can also be designed to provide re-routing and fault tolerance in the event of equipment or link failures. With network data rates constantly rising, this architecture provides a future-proof data distribution system that can be depended on for years to come. Today, common network backbones operate at 10, 40 or 100 Gigabits per second, with individual links operating at 1 Gigabit per second, far in excess of the required bandwidths needed to support PCM data, and far in excess of the data rates supported by todays coax range infrastructure. The commercial use of networking technology and the economies of scale that are achieved by using this technology make the cost of TMoIP infrastructure extremely attractive with the commercial markets driving down cost and driving up data rate and performance.

Adding Best Source Selection (BSS) to the TMoIP infrastructure provides the added capability of combining multiple inputs into a single best quality output. By aligning the input sources in time and then doing a weighted majority vote based on the quality of the input source, the BSS can achieve over a 5 db improvement in received signal quality. Working with the Data Quality Encapsulation (DQE) and Data Quality Metric (DQM) that is transmitted from the receivers over the TMoIP infrastructure, the BSS is able to automatically switch inputs as a transmitting vehicle passes from one antenna view to another based on the quality of the received signal. While a matrix switch may be able to be programmed to sequentially switch between inputs, it currently cannot do it based on the quality of the data being received.

Control of the entire TMoIP ecosystem including Receivers, Gateways, Best Source Selectors, Recorders, Decommutation and Processing systems is handled in an easy to use, intuitive software application called *Telemetry Range Management System (TRMS)*. This software hides the complexity of the network infrastructure and addressing from the users, allowing them to make simple connections between sources and destinations and incorporating virtualized intermediate devices as needed providing a true Software Defined Network for Telemetry Range Data distribution.

Telemetry Range Management Software (TRMS) offers complete control of all range assets (Best Source Selectors, Receivers, Data Processors, TMoIP Transport Devices, Ethernet Recorders) in a user-friendly interface.

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