Technical White Paper

CODAN
RADIO COMMUNICATIONS

MIMO for increased network flexibility and bandwidth

www.codanradio.com

Overview

While LMR Radios have wide range coverage and are optimized for voice compared to typical Wi-Fi coverage, the data transfer capabilities are limited by comparison. For applications where a larger data transfer requirement is required LMR radio is limited. While sufficient for a typical home, it will be insufficient in a larger structure.

What if you needed to transfer higher data rates around a localized area of a few city blocks between users? A Wi-Fi router will give you higher data rates, but using multiple connections makes the complexity of a local network go up rapidly. The nature of Wi-Fi is also affected by such things as walls getting in the way.

Why MIMO (Multiple Input Multiple Output)?

MIMO technology takes advantage of multiplexing antennas to increase wireless bandwidth and range. MIMO algorithms send information out over two or more antennas and the information is received via multiple antennas as well. On normal radio transceivers, multiplexing would cause interference, but MIMO uses the additional pathways to transmit more information and then recombines the signal on the receiving end. Multiple antennas for both transmitters and receivers vastly improve communication performance which allows for the use of a high data rate.

Combined with using an unlicensed band for broadband mesh networks provides a reliable, secure, scalable, high performance foundation upon which to operate one or many business essential applications. Using the Silvus SC3500 provides the user with a roving micro cell system of a public safety system (see Figure 1).

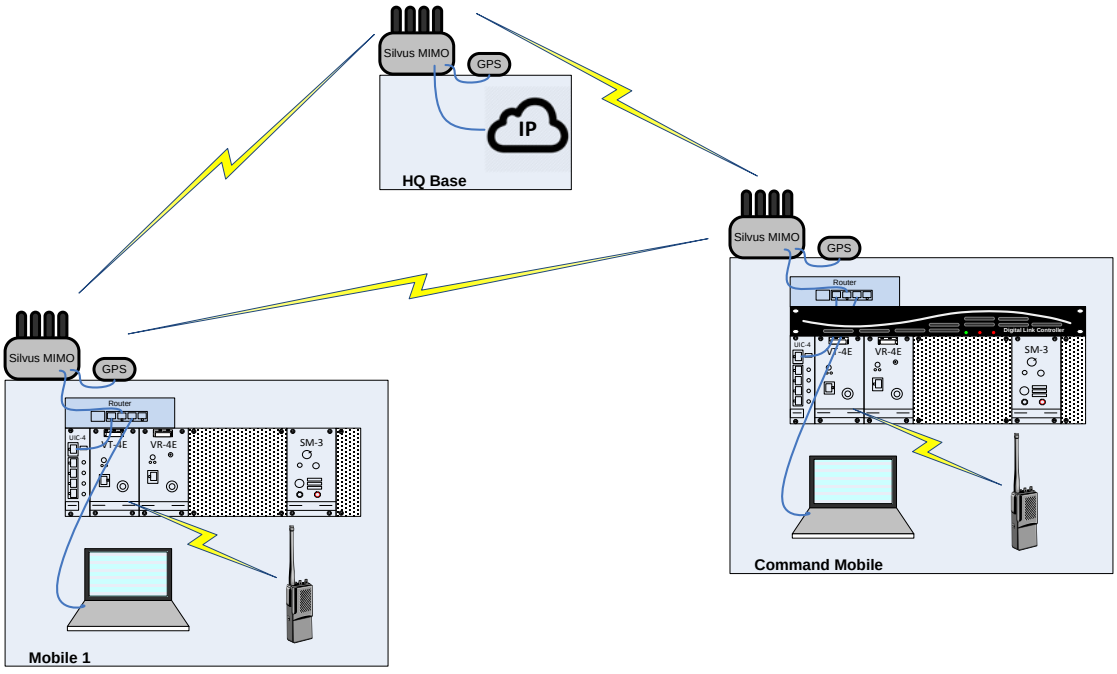

Figure 1: Basic Self-healing MIMO Network

Compared to conventional single antenna solutions, field trials have validated the following benefits of MN-MIMO (Mobile Networked – Multiple Input Multiple Output):

- 4.5x coverage increase in dense urban terrain
- 10x less transmit power for same range and throughput
- 2x increase in LOS range
- 2-4x increase in data rate

Each transceiver enables bidirectional networking to simplify logistics. As an Ethernet bridge, the SC3500 is capable of simultaneous support for multiple network applications, and a multitude of configurations are accessed via web pages within the radio.

The native StreamScape software allows for real-time management of all the radios in the network for transmitter power, frequency, channel bandwidth, link adaptation and other parameters.

Automatic link adaptation changes the radio operating parameters in real-time to provide performance as close to capacity as possible while not losing the link when abrupt changes in channel conditions occur such as moving around a corner or entering a building.

Benefits of Rapid Deployment - Added Range, Security and Expandability

The Silvus StreamCaster MIMO radio is the world's first MIMO radio ruggedized for military and public safety applications. The platform provides a reliable communications foundation for deploying safety and security, intelligent transportation, video surveillance and mobile sensor monitoring systems. The Silvus StreamCaster can either serve as a gateway interface for capacity injection into the network or as a node to extend or reinforce network connectivity.

The Silvus StreamCaster transceiver is a stand-alone IP based packet MIMO radio which surpasses the capabilities of traditional single antenna solutions in many aspects and delivers capabilities unique to the target end user, such as:

- Connectivity in NLOS (non-line-of-sight) multipath rich environments typical of urban canyons
- Connectivity under highly mobile conditions on the ground, in the water and in the air
- High data throughput rates
- Mesh network (self-forming or managed)
- Multiple antenna configurations available; omnidirectional, high-gain directional or hybrid.
- GPS and Multicast Support

Designed for creating or expanding higher-capacity networks, the Silvus StreamCaster supports meshing and client connectivity within the ISM frequency band range. The platform provides superior performance and resiliency, and enables the network to be scaled to the highest capacity configurations through deployment of additional Silvus StreamCaster modules.

Combined for use with the Codan LMR radio, the Silvus StreamCaster can be used to transport encrypted voice communications across the data gateway and then to be unencrypted on the receiving side of the mesh network.

The SC3500 is ideal for missions that require superior communications of voice/video/data in Non-line-of-sight (NLOS) multipath rich environments and to meet the challenges of mission critical network deployments in outdoor and harsh environments, such as:

- Machine to machine (M2M) communications for supervisory control and data acquisition (SCADA), process control, process automation
- Intelligent transportation systems / Transit Fleet management
- Safety and security
- Air-to-air & air-to-ground (manned or unmanned)
- Urban ops, requiring video links within a building and with units outside the building
- Autonomous convoy
- Internet access / data backhaul
- First Responder urban network / relay
- Rural and urban settings in fixed, vehicular and man portable configurations

A network of modems can be used to daisy-chain a connection via other MIMO modems to an MIMO modem and internet-connected base station. Network data is able to route through a MIMO network. Using multiple MIMO radios, it is possible to have a high bandwidth self-healing data backhaul or data connection (see Figure 2) with Headquarters.

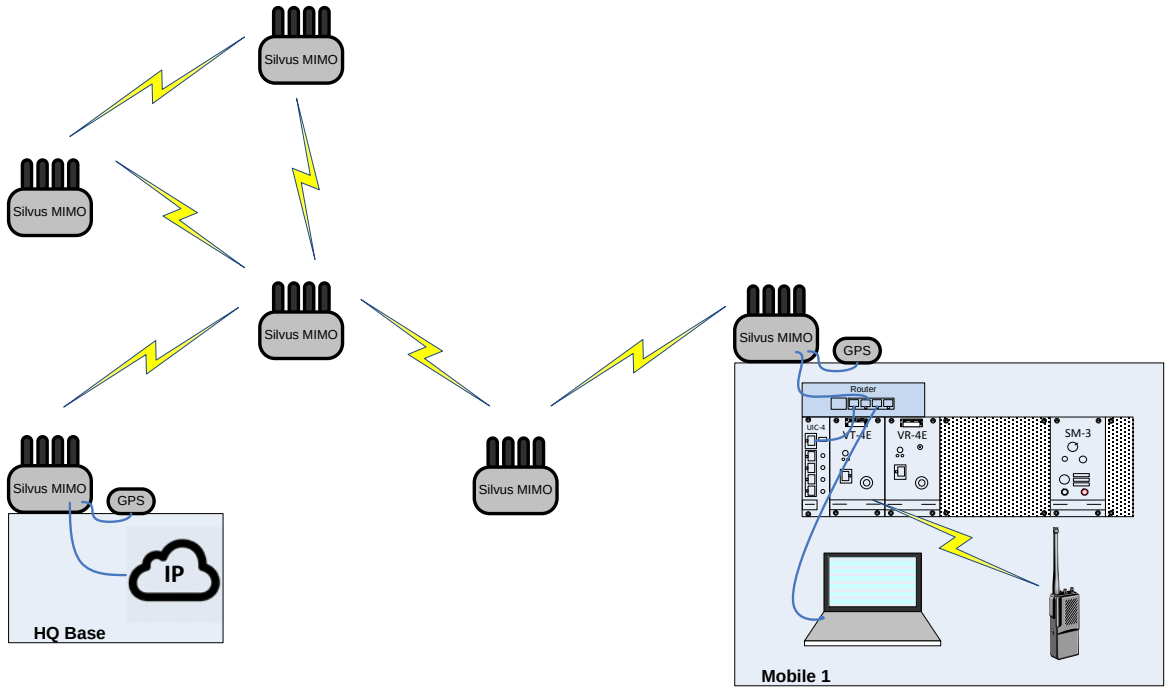

Figure 2: Data Backhaul Across a MIMO Network to an HQ Base Internet Connection