

# Application Note - VoIP Base Stations

## 1) Application

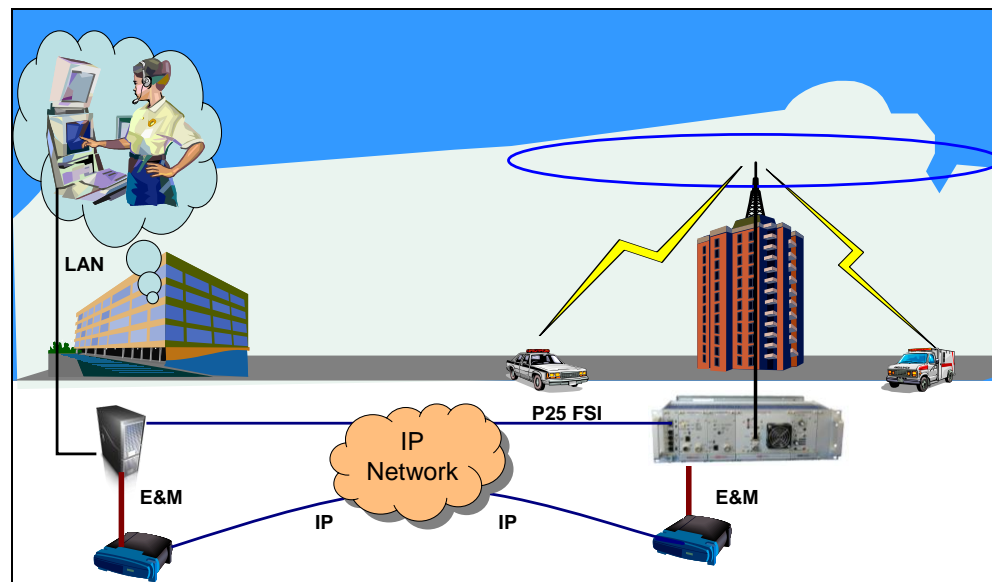
Base Stations and Dispatch Consoles are routinely linked together. Currently this is done via analog interfaces (E&M or tone remotes). Using an IP connection can significantly enhance the features supported, improve the network design and enable interoperability with other IP devices.

## 2) The Problem

It is desired that the Dispatch Console and Base Station be cost effectively interconnected while maintaining digital signaling and digital encrypted audio integrity to facilitate interoperability with other IP communication devices.

## 3) The Solution

An IP connection from the Base Station to the Dispatch Console addresses the above requirements by providing a digital connection using an existing LAN / WAN that maintains the integrity of the audio and signaling information end to end. As shown in the diagram below the Base Station supports a direct IP connection using an interface such as the P25 Fixed Station Interface (FSI) Standard. Digital Audio and signaling are received via the Air interface from a handheld and then passed through the radio in a digital format for incorporation into the IP frames. No analog to digital conversion occurs, digital encrypted audio integrity is maintained and the digital signals are maintained (NAC, Unit ID, Emergency Bit, PTT and COR).



A second approach that is limited in its functionality is the use of an E&M to IP converter box at both ends of the LAN / WAN. This does not maintain digital audio integrity, does not support encryption and only supports basic connectivity signaling. However it does eliminate the need for leased lines or microwave circuits which are expensive to own and operate and, as such has been a very popular advancement over an all analog solution. PTT / COR and audio signals are sent across the LAN / WAN to and from the IP Tone Radio Gateway (in IP format).

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# Voice over IP (VoIP) Base Stations



## 4) The Benefits

A Daniels Electronics base station with built in IP connectivity is shown to the right. The IP connectivity interface (Universal Interface Card) is shown in the left most slot of the rack next to the transmitter and receiver modules. The UIC extracts the digital audio and control signals from the radio and then formats them into an IP frame (P25 FSI or other protocol) for transmission across the LAN / WAN.



The radios in the base station are modular and available in a variety of frequency bands (Lowband, AM, VHF, UHF, T-Band, and 800 MHz), and can be configured into a variety of different systems in a standard 19" subrack. Such systems offer robust construction, low current consumption and extreme temperature tolerance (-30° to +60° C) enabling them to be deployed in some of the world's harshest environments such as Alaska and Siberia. Key benefits offered by an IP based Base Station are:

- **Leased Line Elimination** - An IP connection from the Base Station to the Dispatch Console eliminates the need for leased lines and microwave sites supporting tone or E&M signaling which are expensive to own and operate. This is a cost effective alternative for applications where the base station must be located away from the office or dispatch building for better line-of-site path to repeaters and mobiles.
- **End to End Digital Audio** – IP connectivity maintains the digital audio integrity end to end from the base station to the console eliminating analog to digital conversions and the resulting noise and audio distortion.
- **Encryption** – The IP connection using the P25 Fixed Station Interface standard maintains end to end encryption of the digital audio from the handheld, across the Common Air Interface to the Base Station and then across the IP interface to the console.
- **Additional Signaling** – The IP connection provides additional signaling compared with E&M or tone signaling. This includes Emergency Indication, Unit ID, and NAC code in a P25 system. Faster connection times are also realized compared with tone or E&M signaling.
- **Interconnection** – An IP connection facilitates interconnection from LMR radios to other communication devices that are IP based (cell phones, telephones, PC phones, etc).
- **Open Standards** – Last the P25 Fixed Station Interface standard is an open industry standard that enables all compliant radios and consoles to communicate together.

IP Interfaces from the Base Station to the Dispatch console provide a simpler solution for interconnecting, bringing new features, reduced costs and greater security to Public Safety and other industry applications.



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