

White Paper

Integrating Vocality for Mining

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INTRODUCTION

This white paper is intended to describe the different challenges, compatibility issues and physical and coverage limitations, that result from using push-to-talk radio communications systems in the mining industry.

A typical communication system for mining operations has quarry and underground users equipped with push-to-talk radios. They are connected to bases where a variety of communications devices are in use. This would include hand-held radios, PC consoles, mobile phones and IP-PBX office phone systems.

This document specifically focuses on how Asterisk PBX or other IP-based PBXs are interconnected with users in the mines or quarries. Integration with PC consoles and mobile phones are handled in a similar fashion and are described in a separate white paper.

In mining there is greater demand for more communication capabilities with lower capital outlay. The ability to establish interconnectivity between multiple communication systems offers more users the ability to communicate with one another wherever they are located and independent of the communication devices they are using.

Where achieving connectivity is crucial for daily operations, the ability to deliver reliable and high-quality communications is of the utmost importance. Providing this will result in significant operational improvements, with huge impact for individual businesses and sometimes even lives saved.

This white paper considers flexible open-source systems for implementing telephone private branch exchanges (PBX), like Asterisk, which is based on Session Initiation Protocol (SIP). These form the core of a solution that allows attached telephones to make calls to one another and to connect to other telephone services, such as the Public Switched Telephone Network (PSTN), Voice over Internet Protocol (VoIP) services and radio networks. Using Asterisk PBX to connect these technologies enables communication between more users, without the expense of a full technology refresh.

PROBLEM STATEMENT

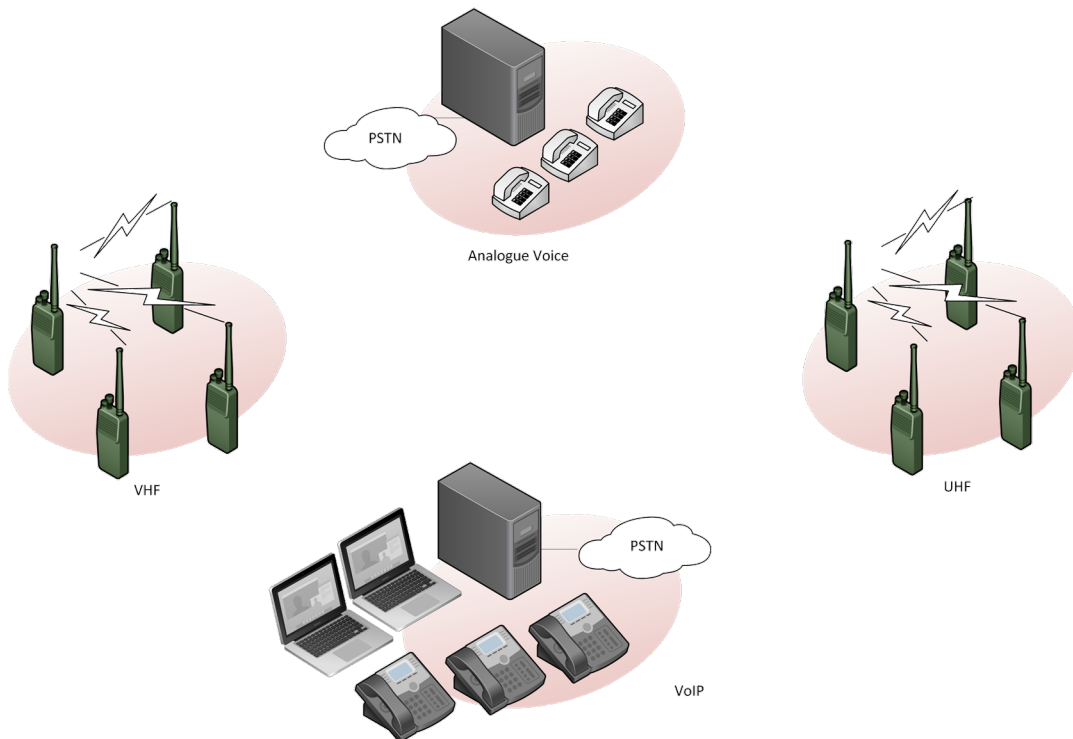
Through time, different types of technologies and infrastructure for communications have been designed with a specific purpose, as a solution to specific needs. Within the scope of voice-communication technologies, we find:

- ▼ radio technologies (VHF, UHF, analog, digital, P25, and Tetra);
- ▼ conventional analog telephone systems (FXS, FXO); and
- ▼ Internet Protocol-based voice communication known as Voice over IP (VoIP).

These unique systems consist of different technologies and all work very well on their own. However, these different systems, often based on the location of the user, have caused a 'natural' isolation; either because of radio (RF) coverage and/or compatibility.

In order to facilitate the high-quality, efficient and cost-effective connectivity that mining demands, it is required that these isolated infrastructures interconnect directly, although they were not originally designed to do so. This includes retaining existing equipment, that has been in operation a long time, and allowing it to interoperate with telephone and other communication systems. If not for this interoperability, a mine would not be able to have unified communications across all of its operations.

Figure 1 Isolated communication technologies and infrastructures



PROPOSED SOLUTION

Introduction of Solution

Bridging the gap between different and isolated technologies is essential. The augmentation of the communications infrastructure adds new capabilities to existing equipment and reduces capital expenditure.

Developing this new infrastructure is feasible with standards-based interoperability. In order to fulfill market demands, our solution observes these design principles:

- ▼ Use of versatile and portable equipment that is able to provide interoperability between existing isolated platforms.
- ▼ Scalable and flexible deployment allowing gradual expansion based on application needs.
- ▼ Based on open-source operating systems. This provides reliable operation, platform independence and adoption of new capabilities inherent in the operating system that results in the rapid development of new features.
- ▼ Cost-effective, lending itself to reuse of equipment.

Application of Solution

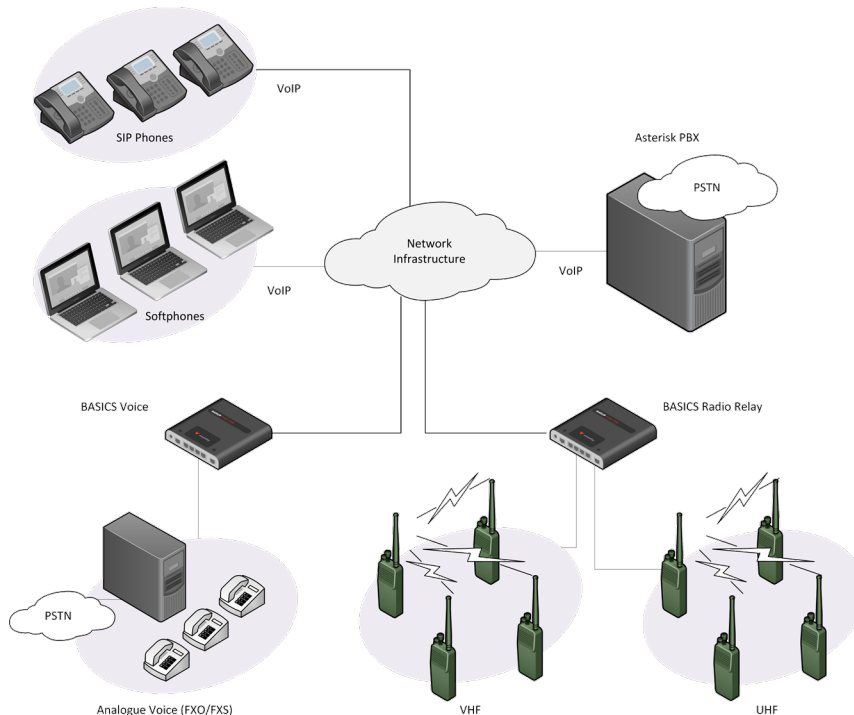
The solution for this augmented communications infrastructure relies on the integration of Asterisk PBX with Vocality products; specifically, BASICS Radio Relay, that is designed to provide radio interconnectivity via Radio over IP (RoIP) protocol and BASICS Voice that is designed to provide conventional analog voice circuits (FXS / FXO) via Voice over IP (VoIP) protocol.

The integration benefits from a unique characteristic that is inherent and common to both technologies: the use of the SIP protocol. This characteristic is key for facilitating the direct interconnection between the existing, previously isolated, technologies.

In this context, the Vocality unit handles each isolated technology independently. And for each, the Vocality unit facilitates their signaling and audio transmission from analog to IP; whereas, Asterisk PBX handles the interconnection between Voice over IP (VoIP) based systems and phones.

Figure 2 shows the proposed solution for deployment of new communications infrastructure that allows interconnection of isolated communications technologies and devices.

Figure 2 Integration of different communication technologies and infrastructures



Additional features and capabilities in the augmented architecture may be summarized as follows:

- ▼ Inherent to Asterisk PBX and now available to radio infrastructures (VHF, UHF, analog, digital, P25, and Tetra):
 - ▼ SIP phones and softphones direct interconnection with radios.
 - ▼ Direct connectivity with PSTN.
 - ▼ Ability to record calls that involve radios, for quality control and fraud investigation purposes.
 - ▼ Ability to include radios in half-duplex tripartite conference calls.
 - ▼ Radios direct connection to Public Address (PA) systems.
- ▼ Inherent to Vocality BASICS Radio Relay and BASICS Voice:
 - ▼ Radio to radio connectivity, known as cross-banding. For instance, VHF and UHF radios are now able to communicate with one another, in either the same or remote locations.
 - ▼ Radios able to call to either analog or IP-based phones.
 - ▼ Analog voice devices (FXS, FXO) direct connectivity with radios (VHF, UHF, etc).
 - ▼ Analog voice devices (FXS, FXO) direct connectivity to SIP phones and softphones, without the need of external Analog Telephone Adapter devices and direct connection to Asterisk PBX.
 - ▼ New RTP filtering feature which allows G711 received packets containing 'silence' to be discarded. This will lower bandwidth usage and make for easier RoIP interaction with radio systems, in some cases removing the need to use DTMF-PTT to activate/deactivate.

DEPLOYMENT SCENARIOS

The following list gives a brief overview of several scenarios and applications that involve integration of Asterisk PBX and Vocality products.

Mining Operations Base with Monitoring and Emergency Response

This solution is designed for organizations where always-on, high-quality communication with miner operations needs to be a day-to-day and minute-by-minute concern. This includes mining operations from emergency response, supply refresh, logistics, and general progress reporting.

In this case, the integration of radio infrastructure to an Asterisk PBX system is achieved by using Vocality BASICS Radio Relay and the SIP protocol. It provides the following advantages:

- ▼ Those at the base are able to use the same VoIP telephone for both users' call handling and radio communication operations. This reduces the number of radios required at the base.
- ▼ The audio conversation between the base and those mines can now be recorded, for quality control purposes, in the very same way it is recorded for regular telephone users.
- ▼ Real-time monitoring is now also available for radio operators.
- ▼ Both phone and radio recordings are time-stamped and stored by Asterisk PBX, so they can be used as supporting documentation or evidence when conducting investigations on suspected fraud transactions.

Radio-to-Phone Interconnection

Mining headquarters operations that require the ability to communicate from any phone extension to specialized groups, that regularly operate via radio infrastructure, are the 'typical' users for whom this solution has been designed.

In this case you interconnect Asterisk PBX with as many Vocality BASICS Radio Relay devices as needed, via the SIP protocol. In general, one Vocality BASICS Radio Relay port is associated with one radio group.

The advantage this integration provides is that the caller will get an immediate response from radio-based personnel. Some examples of organizations that operate with this solution are:

- ▼ Large mine operations where real-time communications between many remote offices and mines is a requirement.
- ▼ Those operations where communications need to be patched between administration, security, maintenance, and miners in real-time.

Public Address System (PA)

This solution allows specialized groups in an organization, whose communication is primarily over radio infrastructure, to have direct access to Public Address (PA) systems within that organization.

This capability is achieved by interconnecting Asterisk PBX to Vocality BASICS Radio Relay, via the SIP protocol. PA function is then achieved either via 'PA over IP' that would deliver announcements through the telephones and/or through traditional PA systems, which have been integrated to the Asterisk PBX as well.

In addition to radio-direct-announcement functions, Asterisk PBX offers PA group management capabilities that allow announcement delivery in a selective way. For example, to specific users or groups of users only.

Mining and energy organizations have implemented this solution in their operations, benefiting from the ability to broadcast announcements directly to the field without intermediaries.

CONCLUSION

The integration of Vocality products with Asterisk PBX, or other IP PBXs, results in an augmented network that provides interoperability between disparate communication platforms and technologies. This network architecture is customizable and scalable according to the requirements and budgets of different businesses, in an efficient, easy to deploy and cost-effective way. Customers no longer need to refresh all of their equipment when they need additional capabilities to expand their closed communications infrastructure. Most importantly, voice communications are provided to more users, which provides greater situational awareness and streamlines activities leading to saving of money and sometimes lives.

ADDITIONAL INFORMATION

Please contact your Vocality representative for more information on how we can help solve your communication challenges.

About White Papers: White Papers are discussion starters or supplementary information written by Vocality technical experts. Should you have queries which are not answered by our current documentation, your local Vocality support team would be happy to hear from you. E-mail support@vocality.com.

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