Paging Considerations for a P25 Upgrade

By Marco Stadler and Philipp Zimmermann

The U.S. public-safety market is in the midst of changing from analog to digital communications technology. In many cases, the driver for this shift has been the switch from analog two-way voice communications to digital Project 25 (P25) infrastructure.

The alerting infrastructure for paging in most cases has been running on the analog network in parallel. For successful migration planning, the future of the alerting infrastructure needs to be taken into account to avoid loss of performance, high costs and frustration of personnel.

Traditionally, analog networks carried both two-way voice communications and the paging systems to alert volunteer and full-time responders. For several reasons, this infrastructure has come to the end of its lifecycle. This is because of technological advances and, in many cases, lack of investment in new infrastructure. The recent switch to narrowband technology has also led to a loss of paging coverage. Not receiving an alert is a nightmare for every committed firefighter who is on standby.

The transition to digital voice communications systems brings great advantages for voice communications, but the paging side is often left with the old analog networks. Along with the lack of coverage, analog paging has additional disadvantages. Pager users are not able to listen to the new P25 ground channel and the operation and maintenance of the old analog networks are too costly when used for paging alone.

Compliant and Cost Effective

Many agencies choose one of two solutions to resolve this dilemma, neither of which is compliant with the National Fire Protection Agency (NFPA) 1221 standards or cost effective.
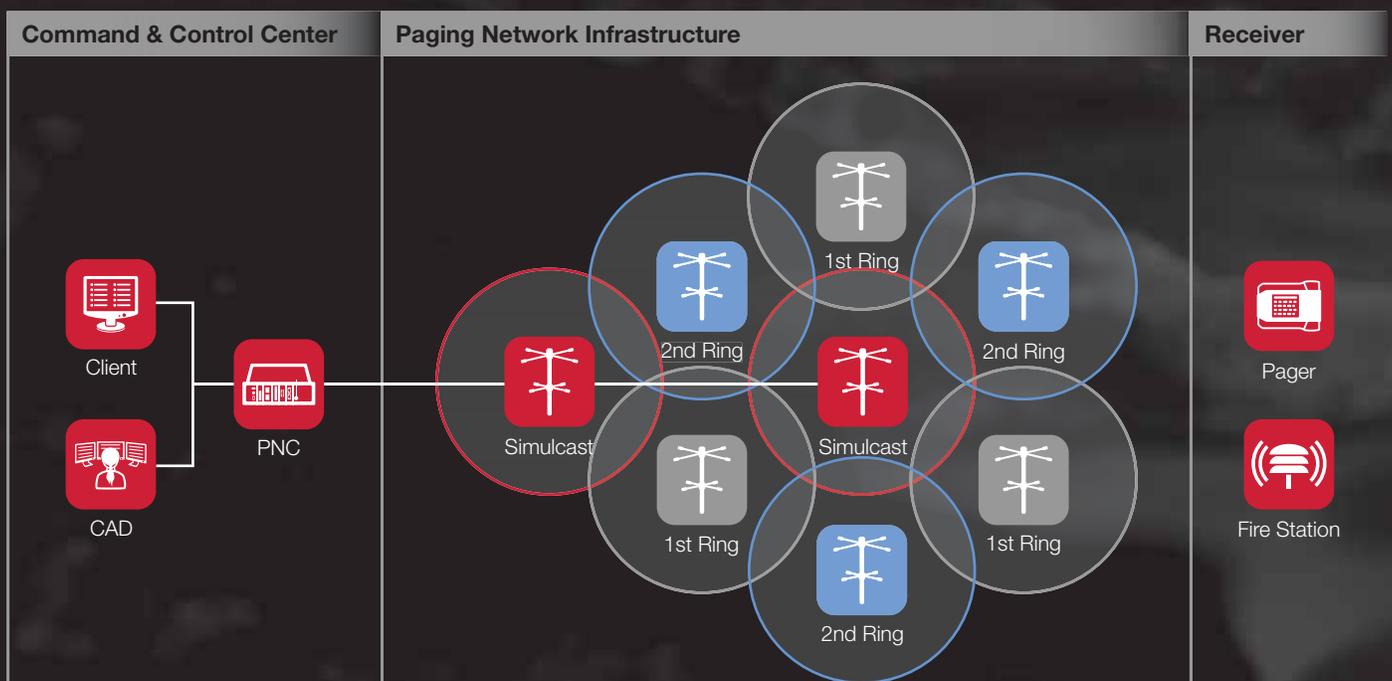
Use P25 pagers on the same network. To migrate analog pagers, some agencies consider using P25 pagers. However, their use comes with four major disadvantages. P25 pagers are costly, priced at nearly $1,000 vs. $200 for a high-quality digital fire pager running on the POCSAG protocol, the predominant global standard for digital paging. For a fleet of 300 pagers, this results in a difference of $240,000. If you consider a fleet replacement every five years, this cost difference increases to $720,000 during a

DiCal – The Smart and Compact Network Architecture

Almost every technology went from analog to digital except for fire paging. Now it is the time for digital paging! The Disaster-Proven Paging Solution (DiCal) from Swissphone offers improved coverage, higher reliability and flexibility beyond anything that traditional analog or digital paging system can provide.

Command & Control Center	Paging Network Infrastructure	Receiver

Client

CAD

PNC

Simulcast

Simulcast

1st Ring

2nd Ring

2nd Ring

1st Ring

1st Ring

2nd Ring

Pager

Fire Station

15-year period.

Pagers based on technology designed for two-way radio devices are quite big and bulky and need to be recharged every one to two days. In comparison, high-quality digital pagers are slim and can run up to three months on one battery, making them convenient for volunteer firefighters who carry their pagers every day. Additionally, digital pagers can be operated for months on a single AA battery, an ideal solution in the case of a power outage or as a permanent solution for agencies that want to avoid the cost of battery chargers altogether.

P25 networks are often designed and built for outdoor coverage. Alerting networks built specifically for volunteer firemen typically have higher requirements, both in regard to coverage in remote and rural areas and in terms of in-building coverage. Consequently, even with modern P25 pagers, firefighters may not receive an alert. Given the cost of P25 base stations, it would be costly to densify the P25 network to make it comply with the requirements of an alerting infrastructure for firefighters.

A combined communications and alerting infrastructure is not redundant because it operates as a single network without a secondary or backup network, making it vulnerable during times it is needed the most. That is why the NFPA 1221 standard asks for separate communications and alerting networks.

Use cellular-based services to alert first responders. Smartphone apps have seen large growth during the past few years thanks to the marketing efforts of the startup companies behind these services. But they come with several drawbacks for public safety.

App-based messaging services run on commercial cellular networks. These public networks may work fine in normal situations. However, during a crisis such as a tornado, large fire or earthquake, this communications channel can be overloaded within a few minutes and eventually go out of service. When firefighters are needed the most, they cannot be alerted and therefore cannot respond to action.

The NFPA 1221 standard explicitly exempts alerting solutions based on commercial telephone infrastructure (9.1.1.3.3, 9.1.1.4 (5)). Settling for app-based alerting services while at the same time investing heavily in a state-of-the-art P25 system for voice is not a wise place to cut costs when you're trying to improve overall public-safety services.

For these reasons, switching analog paging to P25-based alerting or cellular-based messaging solutions is not viable when planning to go digital with mission-critical communications systems.

A Third Option

Swissphone offers a third solution including turnkey digital alerting infrastructure that improves coverage and reliability beyond traditional analog tone and voice-paging systems. The system is the next level of "simulcast paging." The system is fully redundant to a P25 system and thus in full compliance with the NFPA 1221 standards.
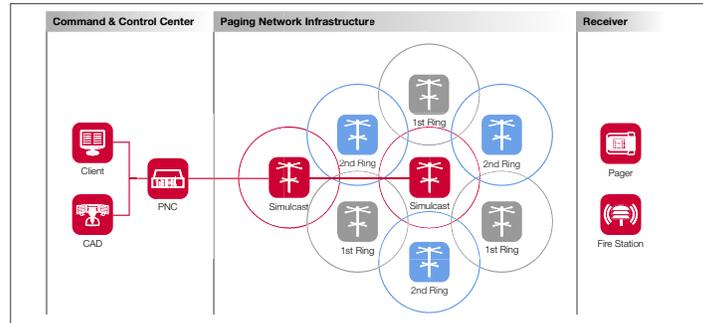
The devices are easy to carry and run up to three months on one battery. The network architecture enhances coverage beyond that of a P25 network, making it adaptable for firefighting agencies. The cost is about 5 percent of the cost of an entire P25 project, and it includes a network controller, base stations, pagers and dispatch platform.

The digital paging solution is based on the POCSAG protocol, which meets all relevant NFPA 1221 requirements for alerting. The interface to the CAD system shortens the time for dispatch and improves response time. Unlike analog voice paging, the dispatcher does not need to prepare or wait and speak the message to be transmitted. The dispatcher can send predefined alphanumeric messages immediately. Also, having a redundant digital paging network alongside the P25 network reduces possible radio transmission and channel conflicts, reducing dispatch time even further.

Patented DiCal technology allows base stations to communicate over a backhaul network, but also over the air, using a single frequency/channel for alerting, monitoring and configuration. The base stations are energy efficient and can be powered by solar panels and batteries if needed. Additional transmitter sites don't rely on an IP or microwave connection for backhaul. The base stations can therefore be placed at any location at little cost, allowing optimal rural and indoor coverage.

The network architecture is fully redundant, allowing continued operations if any of its components are out of service. Also, it consists of several fallback layers to the point of alerting the entire network from any base station if other systems are broken.

The s.QUAD pagers are durable as demonstrated by a 6.5-foot drop test onto concrete. They are also waterproof with an IP-67 rating. The units remain operational up to three months without battery recharging. If needed,

they also run on one standard AA battery.

The pager comes with a standard Bluetooth low energy (BLE) connection, allowing it to connect to smartphones. This functionality enables the pager to respond to an alert or change a responder's availability status, displayed and managed in the dispatch platform. The unit is also capable of being both an analog voice pager and a digital alphanumeric pager. A simple firmware update allows users to turn the analog device into a digital one.

As a third component, the system comes with various alerting clients as well as a software platform, enabling resource monitoring. Operations directors can view the availability of relief forces or the effective strength of teams and groups on a display screen and then alert as necessary. Also, they will know which firemen are responding to an incident and where they are.

Thanks to the BLE interface of the pager, the same platform allows for hybrid alerting and messaging, with the pager receiving the alerts via two networks — the paging and cellular networks. Should reception on one network be inadequate, the alerts are received via the other network. The pager's alert suppression feature ensures that the pager doesn't go off twice for the same alert.

Blackhawk County

Black Hawk County, Iowa, is a leader in public-safety communications technology with a history of early adoption of 800 MHz trunking and pioneering text to 9-1-1. Its territory covers 573 square miles, which was previously covered by a single analog base station, along with two store/forward repeaters for two-tone paging.

When county officials started planning for a switch to P25, they wanted to improve and modernize their paging system rather than simply replacing it with the same technology they'd had for the past 20 years. They leveraged the five planned P25 tower sites for enhanced simulcast coverage with paging base stations and have the flexibility to further extend coverage as the county grows.

The resulting NFPA compliance of the combined solution was one of the reasons why the entire project received funding by elected county officials and was purchased from RACOM, Swissphone's distribution partner and local project integrator for Black Hawk County. The implementation and rollout of such a system takes only a couple of weeks. The base stations can be placed where they are needed: rack mounted on existing tower sites or wall mounted on every other location.

"Deploying digital simulcast fire paging will lower our overall cost, increase

coverage and decrease response times," said Cedar Falls Fire Rescue Chief John Schilling. "We're excited to be deploying the DiCal solution from Swissphone to our fire and EMS first responders throughout the county."

   It is worthwhile to consider both voice communications with radios and alerting with paging when switching to P25. A planned migration of P25 is the best moment to plan a paging upgrade to increase coverage where you need it, shorten the alerting time, reduce operational costs, improve user acceptance and compliance, and be fully in line with NFPA 1221 standards. As in the case of Blackhawk County, a combination of a digital migration to both P25 and digital paging at the same time can significantly increase the chance of funding for the entire project. This opportunity makes it worthwhile to specify the future paging solution when applying for P25 project grants.

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