WHITE PAPER

Critical Connections: Updating Fire Alarm Communication Pathways

ADT® Commercial

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Executive Summary

The communication path to the central monitoring station is a critical safety function of your fire alarm system. Yet evolving and variable codes, standards and technologies can influence the effectiveness of fire alarm systems in emergency situations.

According to the National Fire Protection Association (NFPA), in 2019, 481,500 structure fires occurred in the U.S., causing $12.3 billion in property damage. For this reason alone, using an up-to-date, working fire alarm system should be considered an essential component of any business's life safety and security program.

NFPA 72, the National Fire Alarm and Signaling Code, is the standard for installing and maintaining fire alarm systems. The model building codes, such as the International Building Code (IBC), reference NFPA 72 be used as the installation standard. The IBC 2018 references NFPA 72 2016. NFPA 72 2019 is published and as jurisdictions adopt it, later editions of the building codes will become widely enforced. The 2022 edition of NFPA 72 just completed the second draft meeting as of November 2020.

Model alarm codes mandate your fire system be monitored by a supervising station, commonly referred to as the central station. For example, the International Code Council IBC 2015 requires fire alarm systems be monitored by an approved supervising station; this can be found in section 901.6.3.

Some buildings may have sprinkler system monitoring but not a complete fire alarm system with occupant notification. Section 903.4.1 of the IBC requires a suppression system to be monitored by an approved supervising station.

This white paper focuses mainly on communication pathways and the changing technologies that help to ensure signals from the fire alarm panel connect and communicate with a remote supervising station.

A Changing Landscape

Availability and reliability of POTS (Plain Old Telephone Service)

By now it is widely known that, following a request by AT&T, the Federal Communications Commission (FCC) no longer requires the telecom industry to support copper telephone lines.[1] As a result, AT&T has already started a phased sunsetting of plain old telephone line service (POTS).

Analog technology is expensive to maintain in a digital world. Fewer customers and older infrastructure have led to increasing failures of POTS lines. When failure occurs, the providers often lean towards broadband alternatives with media converters installed at the customer premises. Traditional POTS lines were powered and switched directly, making them the reliable standard for decades. Newer technology installed at the customer premises has drawbacks for reliability, such as standby power and compatibility with digital alarm communicators (DACT) designed to work on an analog phone line.

As POTS technology becomes completely obsolete, there potentially may be thousands of alarm panels that are not being monitored; therefore, new technology must be implemented at a record pace. It is becoming dangerously common in the industry for phone lines to fail or be switched to another communications platform by the provider, and thereby unable to communicate with the remote supervising station.

Digital Alarm Communicator Transmitters (DACT) provide communications between the Fire Alarm Control Panel and the monitoring central station over a telephone line and have been designed to run on analog POTS lines. Newer phone technology such as VoIP may initially experience issues with both communicating and maintaining proper supervision to the supervising station. One of the reasons for this is errors with data packet compression during transmission allowing for data to become corrupted or lost during the process. New cellular communicator replacements are tested by UL to ensure compatibility with existing DACT transmission methods of communication and supervision, making them ideal for a cost-effective conversion from POTS.

As it relates to standby power, effective February 13, 2019, FCC rules increased the amount of backup power that providers must offer at the point-of-sale to a minimum of 24 hours.[2] However, the issue here is that this is an optional feature and not always implemented. It is not uncommon to see a POTS replacement, such as a fiber-optic network terminal tied to DACT with a warning label on the plug that is plugged directly into an outlet with no battery backup.

1 On November 29, 2017, the FCC released a Report and Order (R&O), Declaratory Ruling, and Further Notice of Proposed Rulemaking (Further Notice) addressing (1) retirement of landline copper lines and (2) replacement of legacy services (i.e., traditional Plain Old Telephone Service, also known as "POTS") with next-generation service, such as Voice over Internet Protocol (VoIP).

2 https://www.fcc.gov/document/24-hour-home-backup-power-requirement

Cellular Evolution

The 3G network brought mobile internet to cellular in 1998, with a lifespan of 22 years before sunsetting in 2020. Although the 3G sunset was initially supposed to occur in 2020, AT&T is expected to completely retire the network in February of 2022; Verizon sunset is expected in December 2022.

Today's most common communications standard is 4GLTE and is not expected to begin the sunsetting process until 2030. Originally, the 4G specification was to meet a minimum of 100 megabytes per second, up to a gigabyte. A majority of hardware in 2009 couldn't support the original 4G network specs; therefore, the second generation of hardware known as long-term evolution, or LTE, was launched to meet the original network specification. In 2013, new cellular networks were the 4GLTE standard.

Next on the horizon will be 5G, although it is not expected to be widely available until 2025. It is expected that most 5G devices will rely on the 4G backbone, especially in more rural areas. For critical systems, lower 4GLTE bands with moderate data can be a more reliable option because of the more extensive coverage area and higher signal penetration into the building materials.

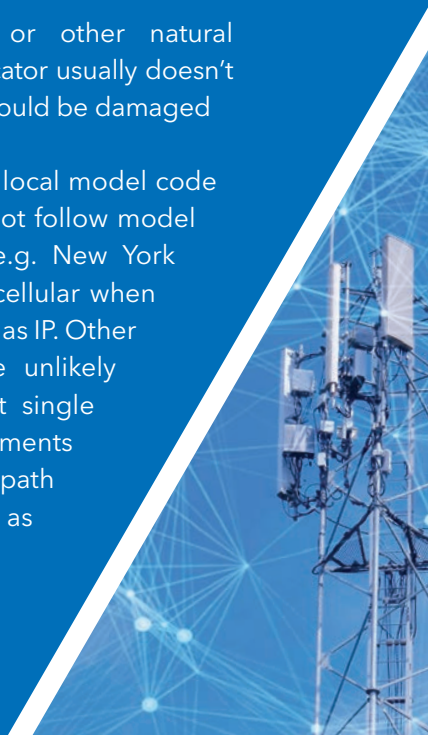
Cellular radios have a supervision heartbeat; if communication is lost, the provider will send a trouble signal to the central station after an hour.

Cellular Fire Alarm Communication

Benefits of cellular communication

- Cellular radios have a supervision heartbeat; if communication is lost, the provider will send a trouble signal to the central station after an hour
  - Phone lines only check in with the central station daily or every six hours in some cases
- The cellular communicator provides an equal standby battery to the fire alarm system
- Older POTS phones sourced power from the phone provider and did not rely on building power
  - Newer phone technologies offer battery backup as an additional option at a cost to the customer– **however, the battery backup is unsupervised, potentially making it unreliable when you need it**
- Although a sole-path cellular communication uses a single technology with one physical connection to the fire alarm system, it provides multiple paths to the central station via a robust cellular network
- Newer phone technology, such as fiber-optic network terminals or ONTs, uses single fiber, even though two phone lines may be connected to the device
- During emergency weather or other natural disasters, the cellular communicator usually doesn't rely on local infrastructure that could be damaged

It's always important to verify your local model code standards; some jurisdictions do not follow model codes or have modified them (e.g. New York City). FDNY standard only allows cellular when used with another technology such as IP. Other more rural areas where you are unlikely to have two cell towers to meet single technology performance requirements may also require an additional path such as IP as primary, and cellular as a backup.



How cellular communicators work

The cellular communicator acts as a relay to the network operation center (NOC), retransmitting signal to the remote supervising station, also known as the central station. The DACT interfaces with the communicator the same way it would with a POTS. The DACT connects by dialing the central station; the communicator acknowledges—also known as a "handshake"—and the DACT then sends the data string for the alarm signal before receiving an acknowledgment that the process is complete. The data is immediately retransmitted to the central station with the same communication formats. Today's cellular communicators are fast, avoiding lengthy delays in retransmitting signals. Typically, two methods are used. The first is a primary IP, known as a Dialed Number Identification Service (DNIS), over the internet to the receiver, and the second could be a backup method, such as connecting a public switch telephone network to the receiver.

Unlike POTS lines checking in with the central station once a day with a test signal, the cellular communicator sends a heartbeat data packet to the NOC. If the NOC loses communication for a defined period defined by NFPA 72 for supervision, typically one hour or less, a trouble signal is generated and sent to the supervision station. Although with a single communication path per NFPA 72 26.6.3.3, it is possible to have the performance of two paths. The communicator uses one technology for physical connection to DACT, and multiple paths of reliability can be implemented for communication. For example, this can be accomplished by choosing the cellular provider with more than one tower in the area. The communicator connects to the tower with a stronger signal, and if the signal is lost, the communicator will use the alternative cellular tower.

When it comes to reliability, phone lines and IP internet services can be interrupted by many conditions, such as power outages, downed utility poles, or damage from digging, to name a few. Cellular carriers are all about speed and reliability with extended standby power, fiber and microwave internet communication. When a disaster or failure occurs, cellular carriers are quick to set up mobile towers to swiftly improve coverage. Towers also operate as distributed antenna systems (DAS) to smaller towers known as microcells.

▶▶▶ **The cellular communicator acts as a relay to the network operation center** (NOC), retransmitting signal to the remote supervising station, also known as the central station.

Savings to customer

Besides increased reliability, the savings and short-term return on investment can drive the decision-maker to invest in cellular communication. Although a cellular communicator's lifespan could be as long as ten years, we will use five years as an example.

▶▶▶ An average savings of **$4,000 over five years** may be realized.

Example

Commercial fire with legacy POTS costing $50 or more per line per month could be as high as **$1,800 per year**.

After investing in equipment and labor, typically under $1,000, and **average savings of $4,000 over five years** including additional cellular service costs may be realized.

Requirements for permit, notification and documentation

Changing the communication technologies may be considered minor work and therefore may not require a formal permit, but always notify the local Authority Having Jurisdiction (AHJ), which in most cases would be the Fire Marshal's office, for existing systems.

▶ Upgrade of an existing cellular communicator

Upgrading an existing 3G cellular communicator to 4GLTE is usually considered regular service or minor work, not requiring a permit. Minor work is defined as replacing a like device with no modification to the fire alarm control unit. If changes are made, such as monitoring cancellation or lapses in monitoring, the current edition of NFPA 72 requires additional notification to the AHJ.

▶ Upgrade of POTS to a cellular communicator

In some cases, the AHJ may have an all-electronic review process in lieu of the full permit and inspection process. In those cases, the Fire Marshal might ask for the following instead of the formal permit or inspection:

- A letter from the licensed contractor with the scope of the communication path upgrade, including when it was installed and tested per the NFPA 72 standard that applies
- A product datasheet and battery calculation

New Monitoring Trends

In the past year, the fire alarm industry has seen an increased demand for two-way voice monitoring for both Areas of Refuge and elevators. The highest demand is originating from new construction where POTS lines are not available with tip and ring voltage to power the elevator phone. This demand is expected to increase as the POTS infrastructure fails for existing equipment.

The existing technology for wireless interface to an Area of Refuge and elevator is still limited. However, technologies are evolving, making products available that can provide online supervision where POTS-driven phone lines don't have the universal compatibility to work by using power from the provided phone line output.

Conclusion

While analog modes of communications, like POTS lines, are quickly becoming obsolete, even newer cellular methods are evolving just as quickly to more sophisticated methods as well. 3G, for example, is now scheduled to be completely phased out by February of 2022. Currently, 4GLTE is the most prevalent, but also on track to begin the sunsetting process by 2030. 4G is on track to serve as the backbone for the next cellular advancement on the horizon as 5G devices become more widely available by 2025.

In many cases, fire alarm integrators are at the forefront in helping AHJs and businesses alike stay up to date on the latest trends in technologies and changes in life safety codes and standards.

Properly monitored, supervised and maintained fire alarm and life safety systems can provide the earliest possible warning of an event and serve as the first line of defense against the risk businesses face from catastrophic loss due to fire. But fire alarm systems must have the most reliable communications pathways available so they can quickly alert authorities in emergency situations.

ADT Commercial delivers industry-leading technology and solutions to the fire and life safety community through district offices across the country and its dedicated, industry-unique National Fire and Life Safety Team (NFLST). We utilize NICET Certified (National Institute of Certification in Engineering Technologies) technicians, installers and inspectors. Our staff members also enrich their life safety knowledge with additional certifications and advanced courses in fire and life safety. Our team is ready and available to help organizations ensure compliance with new regulations and adapt their current fire and life safety solutions to meet new technology requirements, whether you operate a single location or hundreds of facilities across the nation.

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