

# BEST PRACTICES IN OVERHEAD PAGING FOR HEALTHCARE FACILITIES

## HOW A NETWORKED PUBLIC ADDRESS SYSTEM ENHANCES SUSTAINABILITY, SAFETY AND EFFICIENCY FOR PATIENT-CENTERED CARE

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### INTRODUCTION

Successful audio consulting engineers partner with architects to help them stay on top of communication and overhead paging trends, win bids and exceed client expectations. Particularly in the design or renovation of healthcare facilities, the consulting engineer plays a key role in making sure the project meets evolving standards for safety, emergency preparedness, business continuity and the latest “concierge” approaches to patient-centered care.

Effective overhead paging management can be a significant tool that is “heard but not seen” in promoting a calm, healing environment and sustainable, future-proof facilities.

Increasingly, the consulting engineer’s role is to partner with architects and/or hospital IT teams to deliver a flexible, efficient system that contributes to the well-being and safety of patients, visitors and staff, and delivers a greater return on investment.

This paper reviews current industry trends, as well as the role that network-based public address (PA) plays in future-proofing hospital PA systems to improve overall communications and operations, as well as enhance the patient, staff and visitor experience.

Two key points will be addressed:

1. How sustainability and networked architecture go hand in hand.
2. Why the change towards safety and efficiency should include all systems.

## TOP HEALTHCARE TRENDS THAT MAKE NETWORKED PUBLIC ADDRESS SYSTEMS ESSENTIAL

Sustainability is on everyone's minds, followed closely by other top trends including emergency preparedness and business continuity; and the role that every aspect of hospital infrastructure and systems need to play in improving the health and well-being of building occupants.

The increased emphasis on hospitality or concierge-type services that cater to patients and visitors is changing the guidelines governing general noise levels and emergency voice communications. Architects, consulting engineers and hospitals are re-considering all environmental sound; the manner in which staff communicate; and the impact this has on patient comfort and mass communications. These factors contribute to the role new public address and emergency communications systems play in hospitals' overall competitiveness and their ongoing success in providing a healing environment.

### TREND #1: SUSTAINABILITY

The drive to sustainability is one of the top reasons hospitals are replacing or upgrading building structures, equipment and systems. Forty percent of facilities managers surveyed in 2011 by *Health Facilities Management* magazine said that more efficient equipment would result in cost savings. Compliance with new standards and regulations is the reason 32 percent surveyed gave for replacing equipment.<sup>1</sup>

Future proofing—which ensures equipment and systems are flexible and scalable in order to meet a hospital's changing needs—is one aspect of sustainability. Networked public address systems, which provide configuration flexibility through a networked architecture as well as scalability, are a prime component of a future-proofed system.

Five to ten years ago, legacy public address systems were the best the market had to offer, despite issues with maintenance and voice intelligibility. These systems gave hospitals the ability to deliver messages throughout the facility via overhead public address. Today, however, the options have expanded to encompass healthcare information technologies (health IT), bringing new awareness of and reliance on network-based solutions.

From Electronic Health Records (EHR) to Unified Communications (UC) initiatives, healthcare facilities are embracing technology to enhance communications, reduce noise and gain access to all types of information.

Traditional overhead public address technology has evolved into advanced network-based critical public address systems that feature decentralized processing and superior intelligibility. These proven networked solutions allow hospitals to take giant strides forward in managing sound throughout hospital facilities, encompassing both public address and emergency communications.

### CHALLENGE:

As an addition to a sprawling city medical center, an architect from a well-known firm has been asked to design a new Wellness Center which fosters a calm, healing environment. However, medical staff who work across campus in interfacility roles will need to be paged, as well as patients and visitors to the new center.

### BEST PRACTICE:

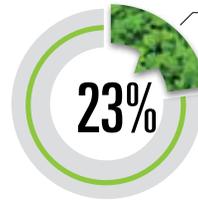
The architect brings in a trusted consulting engineer, who recommends a network-based public address system, not only for the new Wellness Center, but also as an upgrade for the entire campus. The consulting engineer explains that networked architecture allows for seamless integration and future-proof expansion without the need to pull new cable in existing structures. Further, the networked PA system allows for general background music and zoned public address, and it automatically adjusts volume to compensate for ambient noise within each space. The result is a calm, healing environment that can be efficiently extended to the entire medical center. Everyone experiences less stress.

## AGING FACILITIES



Number surveyed who state that more efficient equipment results in greater savings

## SUSTAINABILITY



Number surveyed who state that more efficient equipment results in greater savings

### BUILDING SERVICES EQUIPMENT: TOP REASONS FOR REPLACEMENT OR UPGRADE

Old equipment that needs to be replaced . . . . .	61%
More efficient equipment will result in cost savings . . .	40%
New requirements/compliance . . . . .	32%
New location/space added for future growth . . . . .	19%
Equipment malfunctions/poor performance . . . . .	15%

### BUILDING SERVICES SYSTEMS: TOP REASONS FOR REPLACEMENT OR UPGRADE

Old equipment that needs to be replaced . . . . .	51%
Technological advances . . . . .	30%
New requirements/compliance . . . . .	28%
More efficient equipment will result in cost savings . . .	23%
New location/space added for future growth . . . . .	19%
Equipment malfunctions/poor performance . . . . .	16%

SOURCE: HEALTH FACILITIES MANAGEMENT/ASHE 2011 CONSTRUCTION SURVEY;  
2011 Hospital Building Report, February 2011, [www.hfmmagazine.com](http://www.hfmmagazine.com)

By designing systems that put public address on the network, consulting engineers give hospital IT and facilities management teams visibility into—and control over—a critical communication system. A networked public address system also reduces maintenance costs and vastly enhances the staff and patient experience.

### MAKING DEPLOYMENTS FLEXIBLE:

#### Future-proof a Hospital’s Public Address Infrastructure

Any time hospital administrators consider making investments to improve infrastructure, a key question needs to be answered: “How easy will the system be to upgrade, expand and manage?” Removing or replacing old or inadequate systems is a significant expense. When new technology can overlay or make use of existing systems, hospitals can save considerable time and money.

Consulting engineers can design networked PA systems to enhance, expand or replace traditional analog systems. This solution provides the flexibility hospitals require to meet current and future needs. Networked PA systems are flexible enough to allow installations to start small and expand as funding or construction schedules permit, allowing for an easier retrofit to an existing infrastructure without pulling additional cable.

## CONSTRUCTION FOCUS IS ON FAST RETURNS

Construction projects will be scaled down, with a focus on regulatory compliance, enhancing throughput, improving care/outcomes and, if possible, capturing additional market share. Providers also will prioritize construction that generates superior returns, such as surgical services and imaging centers.

*Healthcare IT News*, January 11, 2011.  
Molly Merrill, Associate Editor.  
<http://www.healthcareitnews.com/news/top-10-trends-2011-include-it-new-care-models>

And, since networked PA systems use a standard network infrastructure, they are easy to install and have a lower total cost of ownership and maintenance. Hospitals can expand a networked PA system as the facility grows, even connecting multiple buildings regardless of their location.

To further protect a public address system investment, make sure it can adapt to changing regulations. A public address solution that is built on networked architecture is easier to upgrade to accommodate new requirements. Networked PA systems built with flexibility are more apt to meet standards and codes today and well into the future, ensuring sustainability for the long term.

### NETWORKED PA SYSTEM SOLUTION AT SOUTHERN CALIFORNIA HOSPITAL

For the facility and IT teams at a Southern California hospital, ensuring their public address system was always functional was a high priority, but extremely challenging. The old system was built from a hodge-podge of various components; wiring was difficult to maintain, hard to troubleshoot, and impossible to enhance for new standards or user requirements. Sometimes the PA system was inoperable for up to a week before facilities and IT tracked down the problem, such as a broken wire to an amplifier no one even knew existed.

When the hospital brought in a consulting engineer who recommended upgrading to a network-based public address system, facilities and IT teams gained complete system supervision—exceeding previous system limitations—and could identify every circuit. Finally they could correct problems before patients and staff noticed. They were also able to add priority public address zones, which future-proofed the system against changing standards.

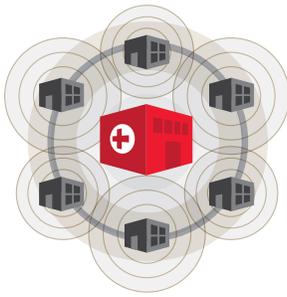
## TREND #2: EMERGENCY PREPAREDNESS & BUSINESS CONTINUITY

A 2004 article in the *Journal of Homeland Security* titled “Recurring Pitfalls in Homeland Security” described intrafacility communications during exercises and actual events as “difficult,” “inconsistent,” “marginal,” and “nonexistent.”<sup>ii</sup> The author also said, “This should come as little surprise, because similar complaints are expressed about everyday operations—that is, a system that doesn’t work well under normal conditions shouldn’t be expected to do so under extreme stress.”

While many hospitals have made great strides in security, consulting engineers are well aware that legacy public address systems at many facilities still cause communications breakdowns in both everyday and emergency situations.

This particular pitfall is one in which having a networked PA system, one that is not limited by size or the location of a hospital’s buildings, is crucial to developing a successful disaster preparedness and business continuity plan.

A public address and communications system that links facilities together enables lines of communication to remain open and operational. Systems with an intuitive architecture and interface allow for easy access and maintenance, and provide the confidence that communications will continue in various alert scenarios.



**Intrafacility Communications**  
is critical for a healthcare facility  
to respond to a community crisis

## EMERGENCY PREPAREDNESS & BUSINESS CONTINUITY

Intrafacility communications are critical in determining whether a healthcare facility can respond to a community crisis—whether natural or man made. A networked public address system can link the whole campus, even if the campus is spread across the state.

## HEALTH INFORMATION TECHNOLOGY

The Health Information Technology for Economic and Clinical Health (HITECH) Act is increasing the focus on new and innovative technology solutions. HITECH provides incentives to hospitals that implement health IT solutions such as Electronic Health Records (EHR), and is increasing the number of technology-savvy healthcare professionals who understand and expect technology solutions to their work challenges.

The Most Wired Survey 2011, conducted by *Hospitals and Health Networks*, recognizes the top hospitals that are leading the industry in health IT implementation. The survey also shows the growing prevalence of health IT measures, from electronic medication orders to system-wide safety alerts. The “Most Wired” hospitals are establishing themselves as leading edge facilities—a definite competitive advantage.<sup>iii</sup>

As hospitals look to technology to further business objectives and solve problems, leading consulting engineers are partnering with architects and/or hospital IT teams to implement a number of network-based solutions. Network-based medical devices, wireless systems, smart phones and VoIP telephone systems are all becoming commonplace.

According to Spyglass Consulting, a research firm focused on healthcare, 66 percent of the hospital-based nurses interviewed reported their organizations had deployed VoIP-based communications.<sup>iv</sup>

Just as VoIP has made PBX telephone systems obsolete, network-based public address will eclipse traditional analog public address. Migrating legacy PA systems to the network provides the same benefits obtained through VoIP telephony: network management and control, cost savings and increased quality and scalability.

### **CREATING SMART SYSTEMS: Get Alerts and Quickly Identify Potential Problems**

System operation is the first area where network-based public address systems have a dramatic impact. If the PA system is a smart system, it continually monitors itself for irregularities and immediately sends alerts if irregularities are found.

- **Notifications:** Immediate system notifications prevent problems from developing and impacting patients and staff. This monitoring ability, coupled with decentralized processing functions, saves hospitals time and money by minimizing maintenance and eliminating the possibility of a single point of system failure taking down an entire public address system.
- **Redundancy:** Most overhead analog public address systems rely on a centralized mainframe unit to route audio signals. Equipment add-ons build in some redundancy to protect against the failure of an individual circuit, such as an amplifier. However, there is no protection against system failure. If the central unit goes down, all public address functionality goes with it.

A network-based public address system decentralizes the processing functions and allows memory and processing resources to communicate intelligently across the network and substantially, increases system reliability. If a switch fails, another signal path is used. A network-based PA system has redundancy not only with an individual device, but with the processing component as well. This type of system architecture does not allow for a single point of system failure.

- **Monitoring:** In addition to redundancy, network-based PA systems provide end-to-end, system-wide monitoring. The system continually checks the devices on the public address network and signals back their status. The ability to supervise all circuits and notify appropriate personnel when problems are detected is critical to maintaining the integrity of the system. For example, if a power amplifier in an area (e.g. a nursing unit) experiences a fault, the system notifies the appropriate personnel who can address the problem before nurses at that station have any difficulty making or hearing pages.

Knowledgeable consulting engineers understand that for hospitals dealing with critical patient care, reliable public address systems are of paramount importance. A networked PA system is built to ensure every page is broadcast, every time. Complete system-wide supervision—coupled with the ability to remotely access the PA system—helps the facilities and IT teams collaborate to successfully manage a networked system.

### **ENSURING SAFETY AND SECURITY: Minimize Risk To Hospital And Individuals**

Every organization has the responsibility to ensure the safety and security of the people in its facilities. Nowhere is that expectation greater than in hospitals—the sanctuary for the sick and injured. In the event of an emergency situation, hospital administrators need to get a large number of people to follow instructions. The inability of emergency notification systems to provide voice instructions may have catastrophic consequences.

**CHALLENGE:  
MULTILINGUAL PUBLIC  
ADDRESS ACROSS LARGE  
HOSPITAL CAMPUS**

A sprawling hospital campus decides to initiate multilingual public address to improve communications with a diverse population. However, the legacy analog PA system creates a “Tower of Babel” effect where few can comprehend what is being broadcast, regardless of language.

**BEST PRACTICE:  
INSTALL NETWORK-BASED  
PUBLIC ADDRESS SYSTEM**

To improve audio clarity and intelligibility, the consulting engineer can recommend the hospital switch to a network-based public address system. Scalable, Digital Signal Processing (DSP) delivers pristine, uncompressed digital audio irrespective of system size, while distributed DSP provides localized fine-tuning of audio parameters to match acoustic environments. A system with built-in ambient noise compensation technology may also further improve intelligibility by adjusting public address volume in real time to adapt to background noise and acoustics. Whether pages are in English, Spanish, Russian, Chinese or other languages; pre-recorded or live, with a networked PA system, the message will be clear.

According to the Fire Protection Research Foundation, “The use of voice communications as an emergency management tool has greatly expanded. In the past, systems that relied on simple, repeating, pre-recorded messages allowed less intelligible communication systems to be effective.

However, changing threats and the use of voice communication systems for a variety of emergencies in a dynamic fashion requires that the systems have an end-to-end communication path that does not hamper intelligible communication between those in command and the target audience.”<sup>v</sup>

Network-based PA systems can integrate with a hospital’s emergency system through a single interface. In the event of a natural disaster, security incident or fire, the emergency or fire alarm system alerts the networked PA system, which then broadcasts the appropriate warning over the speakers on every floor of the hospital’s buildings. Integrating a networked PA system with an emergency system significantly improves overall safety and ensures that voice instructions accompany every alarm notification.

A message server further enhances an emergency public address system. This type of device stores and plays back pre-recorded messages automatically. This setup eliminates any chance of human error in the event of an emergency. It ensures critical messages are broadcast when and where needed, and for however long the duration of the event.

Emergency messages are also stored in amplifier onboard memory. Even during a catastrophic event, emergency messages continue to play as long as the amplifier receives power. The advanced features of a network-based PA system help hospitals better provide for the safety and security of patients and staff.

**INCREASING INTELLIGIBILITY: Make Sure Messages Are Heard And Understood**

Intelligibility is defined as the “capability of being understood or comprehended (distinguishable and understandable).”<sup>vi</sup> Voice alarms that are intelligible ensure that vital emergency messages transmitted through a building’s voice evacuation system are clearly heard and understood.

Poor-quality pages that cannot be understood are a common occurrence in many hospitals. Not only does this create risk for staff and patients, it’s also frustrating. If an overhead page cannot be understood, most people hope that whatever was missed wasn’t important or meant for them.

In a life-threatening situation, the right people must get to the right place as quickly as possible. There is no room for uncertainty. Whether it is a doctor page, a Code Blue, a security incident or a fire, people count on the public address system to broadcast clear messages that everyone understands—every single time.

- **Scalable Distributed DSP:** A networked PA system with scalable, distributed Digital Signal Processing (DSP) facilitates improved audio clarity and intelligibility. Pristine, uncompressed digital audio is delivered irrespective of system size, while distributed DSP provides localized fine-tuning of audio parameters to match challenging acoustic environments.

- **Ambient Noise Compensation:** DSP may also further improve intelligibility through an adaptive response to ambient noise variations—adjusting PA volume in real time commensurate with the background noise and acoustics within a space. These technologies ensure clear and intelligible public address in a variety of ambient conditions.

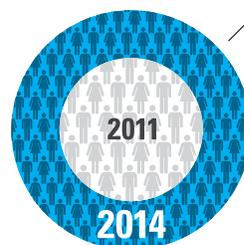
Not only does improving the intelligibility of public address increase the safety of both patients and staff, it also supports hospital and consulting engineer goals of creating a hospitable and comfortable healing environment for patients, visitors and staff.

### TREND #3: ALL SYSTEMS CONTRIBUTING MORE TO HEALTH & WELL-BEING OF BUILDING OCCUPANTS

In the highly competitive healthcare market, it is increasingly important for hospitals to create programs and services that differentiate them. The trend towards a hospitality environment is a natural progression for hospitals. Architects and consulting engineers can play a key role in designing or accommodating patient amenities like private rooms, wireless access and concierge services that let hospitals replicate the experience of a quality hotel—all to increase patient satisfaction and facilitate the healing process.

A partnership between the Rosen College of Hospitality Management and Orlando Regional Medical Center (ORMC) is an interesting study in applying customer service techniques used by hotels to improve overall patient satisfaction and communication.

30-40 MILLION ADDITIONAL AMERICANS WILL HAVE EXTENDED HEALTHCARE COVERAGE IN EFFECT BY 2014



+30-40 million  
More people will have extended healthcare coverage

### FACILITIES MANAGERS WILL CONTRIBUTE TO THE HEALTH + WELL-BEING OF ALL BUILDING OCCUPANTS

Matt Boseo, a doctoral student working at ORMC, says that people rarely think of customer or patient satisfaction until competition or ranking comes into play. “Some might think the hospitality industry has nothing to do with healthcare,

but there is a certain overlap,” says Boseo. “Hospitals are still a business and concerned with approval ratings. More heads in beds means more revenue just like hotels.”<sup>vii</sup>

One significant source of patient complaints is hospital noise. Not only does noise impact patient satisfaction, it also impacts their health. According to the *American Journal of Nursing*, “Studies in adult patients have linked excessive noise to sleep disturbance, and increased blood pressure, heart rate, and stress.”<sup>viii</sup>

Providing calm and quiet through zoning and controlling public address volume can help hospitals minimize noise levels, creating a better environment for healing.

### **REDUCE NOISE: INCREASE PATIENT AND EMPLOYEE SATISFACTION**

Hospitals are noisy places. With all the electronic devices, televisions, voices, alerts and alarms, it is hard to create a quiet, calm environment for working and healing. A 2005 study by researchers at Johns Hopkins University found that the average daytime noise level in hospitals has doubled since 1960.<sup>ix</sup>

## **2 WAYS NETWORK-BASED PUBLIC ADDRESS SYSTEMS SUPPORT NOISE REDUCTION: ZONED PUBLIC ADDRESS & AMBIENT NOISE COMPENSATION**

### **1) Zoned Public Address**

Network-based PA systems support efforts to reduce noise in two ways. First, they allow the creation of public address zones so pages are only heard where they are needed. For all too many hospitals, broadcasting a page to an entire floor or building is the only available option. By using zones, it is possible to create quiet areas within the hospital.

### **2) Ambient Noise Compensation**

Through a feature called ambient noise compensation, networked PA systems automatically detect the ambient or background noise in an area and adjust the page volume accordingly. For example, a busy waiting area may require pages to be louder in order for patients and staff to hear them. However, when the waiting area is no longer crowded, the volume required for pages is substantially lower. By automatically adapting to the room noise, the system doesn't subject patients to excessively loud pages when the room is quiet.

Creating a calm, quiet environment where employees can work and patients can heal shows a hospital's commitment to safety, comfort and health. Recommending a networked public address system shows a consulting engineer's awareness of current best practices in sound management.

As part of a concerted effort to increase patient satisfaction and deliver “patient-centered care,” architects and consulting engineers are designing buildings and systems to combat the excessive noise that patients complain about. For some hospitals, this means creating quiet hours and purchasing headphones for televisions. Others are installing noise-absorbing wall panels and monitoring conversation levels at nursing stations.

Excessive noise also takes a toll on nurses and other healthcare staff. An article in the *American Journal of Nursing* discussed the impact of high noise levels on staff and linked it to “increased stress and annoyance, fatigue, emotional exhaustion, and burnout. And excessive noise can interfere with staff communication, increasing the likelihood of error.”<sup>x</sup>

Not only does improving paging intelligibility increase the safety of both patients and staff, it supports hospital goals of creating a hospitable and comfortable environment.

# CONCLUSION

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By spearheading the move to networked public address systems, consulting engineers can help IT teams and facilities managers dramatically improve hospital environments, reduce costs, minimize maintenance and create future-proof facilities.

- Hospitals are pushing for increased safety and efficiency; consulting engineers can help hospitals succeed under healthcare reform, collaborating with architects and hospital facilities and IT managers to recommend sustainable systems across the hospital environment.
- The best consulting engineers will continue to find ways to cut costs and optimize facility systems and safety, helping to differentiate their hospital clients' brands. Architects will rely on them as valuable partners, who contribute to winning and delivering outstanding, sustainable healthcare projects that exceed client expectations.
- Network-based PA systems enable consulting engineers to address and solve current issues with system maintenance, audio intelligibility and noise, and ensure a solid platform for their clients' future growth and expansion.

When recommending networked public address options, consider the trends on the minds of architects, healthcare facilities managers and IT managers. Key factors to evaluate include:

- **Sustainability and future-proofing**
  - Ease and cost of maintenance
  - Potential to expand or upgrade
  - Ability to meet future needs and standards
  - The quality of microphones, amplifiers, and other system components
- **Emergency preparedness and business continuity**
  - How does the system handle monitoring and alerts
  - Is redundancy built in to eliminate single-point system failure
  - Does the system use advanced digital processing technology to increase intelligibility
- **Public address system's role in contributing to health and well-being of occupants**
  - Can the system be used to foster a quieter, more healing environment
  - Does the system support priority public address zones
  - Does the system automatically adjust PA volume based on room noise

## ABOUT VOCIA® FROM BIAMP SYSTEMS

Biamp Systems is a wholly owned subsidiary of Rauland-Borg, the industry leader in Nurse Call systems. The Rauland-Borg organization understands the demands on hospitals in the operational areas of nurse call and paging like no other.

Biamp is advancing healthcare operations by bringing innovative solutions for overhead paging with Vocia, the networked public address system. Built with advanced audio technologies, perfected by Biamp's 35 years of professional audio experience, Vocia delivers a level of intelligibility that is unsurpassed. As the world's most advanced, decentralized, networked PA system, Vocia is built to meet current and future standards. Biamp is committed to helping hospitals understand the codes and requirements that will impact healthcare.

Vocia provides a number of advantages to healthcare facilities:

- Automates system-wide monitoring of all critical circuits, event logging and automatic notification of system status
- Is intuitive and easy to use/operate
- Increases intelligibility with DSP and ambient noise control
- Enables a quieter, calmer environment through zoned public address
- Uses distributed processing and a highly flexible system design to eliminate single-point system failure
- Provides multiple public address options that include live PA, remote PA, delayed PA and recorded message release (storage and playback for eight simultaneous messages)
- Facilitates compliance with numerous code standards; is ADA compliant
- Integrates with VoIP telephones, PC workstations, digital signage and nurse call systems
- Leverages network-based architecture to simplify installation and reduce ongoing maintenance costs
- Offers low entry costs so hospitals can start with small installations but expand and grow as needed

## NEXT STEPS

Whether you're consulting on a project that involves expanding, retrofitting or new construction, you need to recommend a reliable network-based public address system to ensure the project success, sustainability, as well as the safety and comfort of patients and hospital staff. See how Vocia increases return on investment by delivering the highest-quality monitored PA system, with networked flexibility and expansion potential.

For more information about Biamp's Vocia critical public address and voice evacuation system, please visit [www.biamp.com](http://www.biamp.com).

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## GLOSSARY

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**AMBIENT NOISE:** The level of the total noise in an area. In acoustics and specifically in acoustical engineering, background noise or ambient noise is any sound other than the sound being monitored. Background noise is a form of noise pollution or interference. Background noise is an important concept in setting noise regulations.

**AMBIENT NOISE COMPENSATION:** In acoustics it is the use of adaptive algorithms to adapt to the ambient conditions within an area (background noise, changing acoustics with more or less people in a space).

**DSP (DIGITAL SIGNAL PROCESSING):** A category of techniques that analyze audio signals and convert them into digital data for use within a networked system.

**FUTURE PROOFING:** The process of trying to anticipate and plan for future developments and needs, so appropriate action can be taken to minimize possible negative consequences and to seize opportunities.

**INTELLIGIBILITY:** The quality of language that is comprehensible; a measure of how comprehensible speech is, or the degree to which it can be understood.

**LEGACY PAGING SYSTEMS:** A term commonly used to refer to existing paging systems and applications with which new paging systems and technology

must exchange information.

**PAGING SYSTEM:** A communications system which gives an indication to a particular individual or group of individuals that he/she is needed in a particular area or on the telephone. Indicators are usually given by sounding musical gongs or tones, or directly asking for the public's attention prior to the announcement.

**PUBLIC ADDRESS SYSTEM:** An electronic amplification system used as a communication system in both public and private areas, both inside and outside buildings.

**PBX TELEPHONE SYSTEM:** Stands for Private Branch Exchange, a private telephone network used within an organization. Users of the PBX share a certain number of outside lines for making telephone calls external to the PBX.

**VOIP:** Voice over Internet Protocol (VoIP) is a general term for a family of transmission technologies for delivery of voice communications over IP networks such as the Internet or other packet-switched networks.