A Guide to IP Paging

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Introduction to Learn More:

A Guide to IP Paging

Adoption of VoIP includes convergence of analog paging to networked paging systems.

Normally businesses will not even think about what they are going to do with that analog paging system that has been there for so long. Others still have not even considered the benefits that paging can bring to their operation.

For most, the thought of ripping all of the wire, speakers and amplifiers that come with their existing system can seem quite daunting. For others, the thought of spending additional money can be met with objections.

What follows is a useful guide to IP Paging that looks at the benefits of IP paging for your business such as:

- Shared network infrastructure
- Lower installation and implementation costs
- Seamless integration into existing networks including legacy analog wiring
- Simple installation and configuration
- Scalable to intercoms and paging stations — locally, regionally or globally
- Remote control and simple end-point expansion in intercom systems
- Software based zone management in paging systems

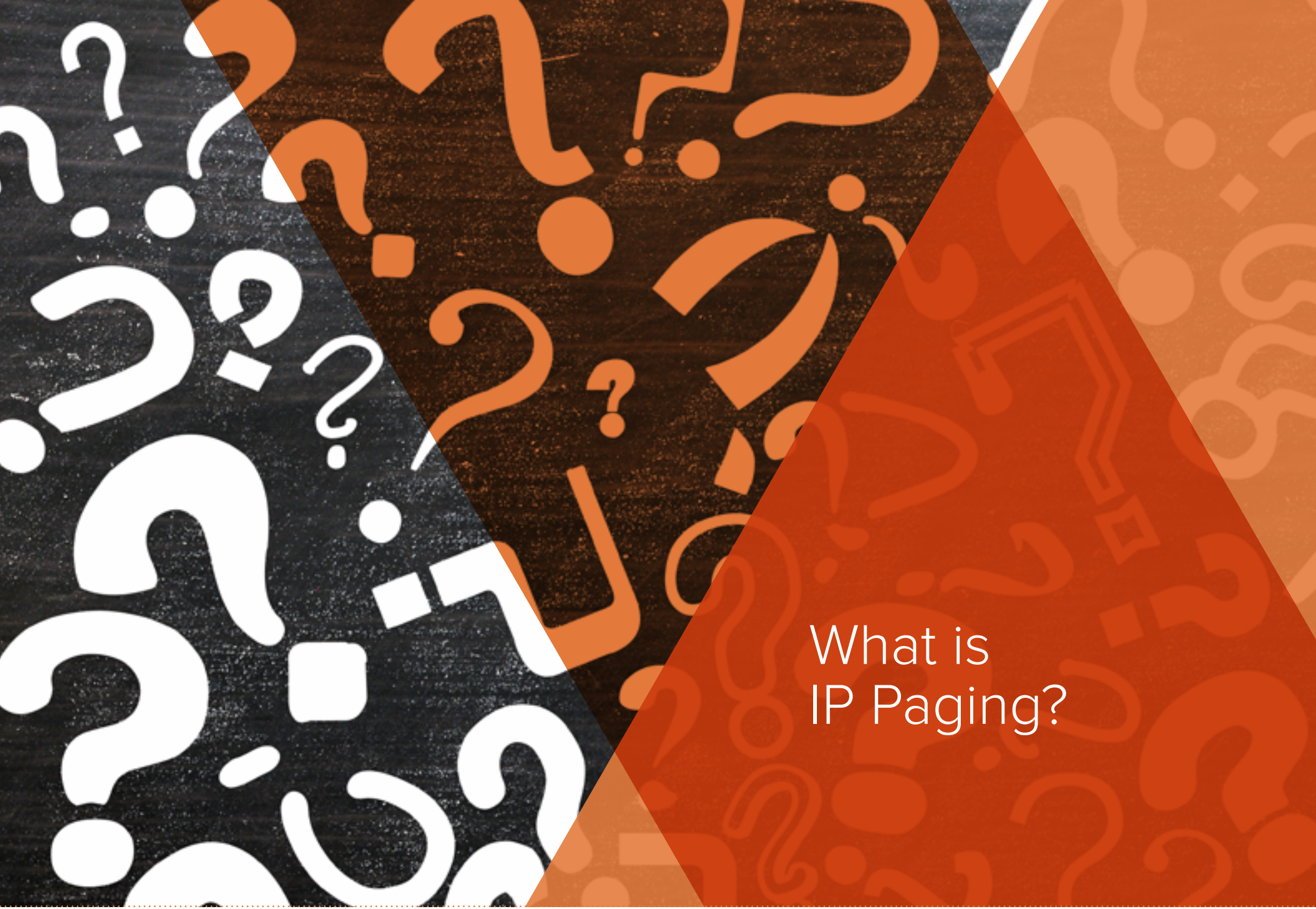
Since everyone's situation is different this guide might not cover everything you need to make the right decision on an IP Paging solution. If that should happen, don't worry. It's what the experts at VoIP Supply are for.

Since 2002, VoIP Supply has helped over 125,000 people just like you create, deploy and maintain a VoIP solution.

If at any point in this guide you get stuck, are unsure of what is being discussed or just want to skip the details and have someone select the right IP Paging system for you, then please give us a call at 800.398.8647.

One of our experienced, vendor-neutral representatives will be more than happy to walk you through the process of selecting the IP Paging solution that is right for you.

Thank you for your time and enjoy the read.



What is IP Paging?

Lots of places such as schools, businesses, hospitals, and factories use mass notification paging systems.

IP Paging is a more powerful version of standard analog notification systems. IP Paging can be combined with your VoIP phone system and data networks. This is what's known as IP convergence and it will significantly increase the efficiency of the technology you already have in place.

Traditional zoned paging systems are proprietary, inflexible, and not easily managed. Oh, and they don't exactly play well with your new IP PBX either. IP Paging Systems, like anything else that is IP-based, offer much greater flexibility than their analog counterparts.

IP networking allows you to:

- Converge all of your separate communication systems into a singular unit.
- Greatly increase organizational efficiency.
- Reduce the number of user-interface devices.

Targeted Messaging

The abilities of an IP Paging system are not limited like traditional systems. IP Paging is not only a common system for all public announcements and emergency alerts but it allows you to target messages to specific telephones, speakers, or areas of the building.

This is accomplished, for example, by the IP Paging system's ability to assign public address speakers a unique address.

Types of IP Paging Equipment

IP Paging equipment is available to provide flexible zoning and enhanced speaker capabilities that do not require your existing investment to be discarded.

Hybrid solutions are possible and a great solution for allowing greater flexibility and better use of resources. The types of IP Paging devices available to upgrade your system are:

1. Legacy Device Connectivity
Products that help in the migration to VoIP.

2. Added Device Connectivity
Products that enable additional functions to be integrated into a VoIP system.

3. Mainstream VoIP Products
Devices that support a VoIP system installation.

Don't have paging? What are the benefits?

Having an efficient paging system may not be a top priority for most management teams but a properly installed system allows you to quickly communicate with your mobile workers and will lessen hold times for internal and external calls.

Also, being able to designate a particular zone for a page will emphasize to employees that they need to pay particular attention to that message. IP Paging systems are a great tool to improve the work flow of your organization which will also benefit your customer's experience.

Two Paging Methods

In many new or existing VoIP deployments, integrating existing paging systems or deploying new IP based paging systems is becoming a much needed necessity.

We will first detail the two common methods that paging is delivered over an IP network:

1. Unicast IP Paging
2. Multicast IP Paging

Paging Methods

Unicast IP Paging

Unicast IP Paging, more commonly known as a unicast page, is delivered on a one to one basis and in our case the IP PBX is the source for this discussion.

In most common unicast paging setups, administrators will set up single or numerous page groups in the IP PBX configuration and they will do this by creating a page group by extension.

Unicast Paging Extension Example
For our example let's use a single page group and assign it to extension number 400.

Paging Group 400 will then contain (20) SIP extensions that belong to individual users on the system and these extensions are physical SIP endpoints such as an IP Phone.

In a unicast paging environment, when a user dials Paging Group 400 from their phone the IP PBX sets up and maintains 20 individual SIP calls between itself and each IP Phone belonging to the page group 400. The PBX sends SIP and RTP audio traffic to and from each one of these endpoints individually.

Not the most beneficial method?
Now can anyone tell me why this method might not be the most beneficial to use?

OK you guessed it, since unicast paging is designed to page on a one-to-one basis; the number of users contained within each page group is the number of simultaneous SIP calls the PBX has to initiate and maintain at that specific moment in time.

Taxing the CPU & Processing Power
As you can see, this can get quite taxing on the IP PBX's CPU and processing power. If the CPU is taxed too much, it can possibly lock up the entire system causing detrimental impact to the server hardware, inevitably drop calls, and affect overall user's productivity.

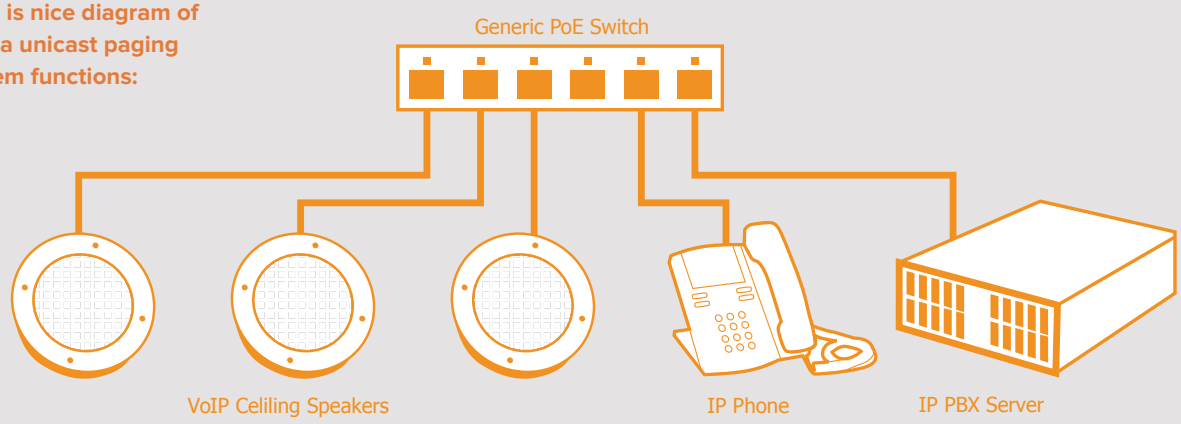
In our case, our PBX has to make 20 SIP calls simultaneously at that given time that the paging extension (400) is dialed.

Unicast Paging Limitations
Unicast paging has some downfalls and definitely some limitations. In most cases, a typical IP PBX can handle around 20 or so concurrent calls without "working too much overtime" and for those environments, unicast paging will function correctly without many issues.

But if your application has 50 or more users in a single page group which is typical for a college, hospital, manufacturing facility, or warehouse application then unicast is just not going to cut it. For that type of environment, we must turn to Multicast Paging.

Typical Installation

Here is nice diagram of how a unicast paging system functions:



Multicast IP Paging

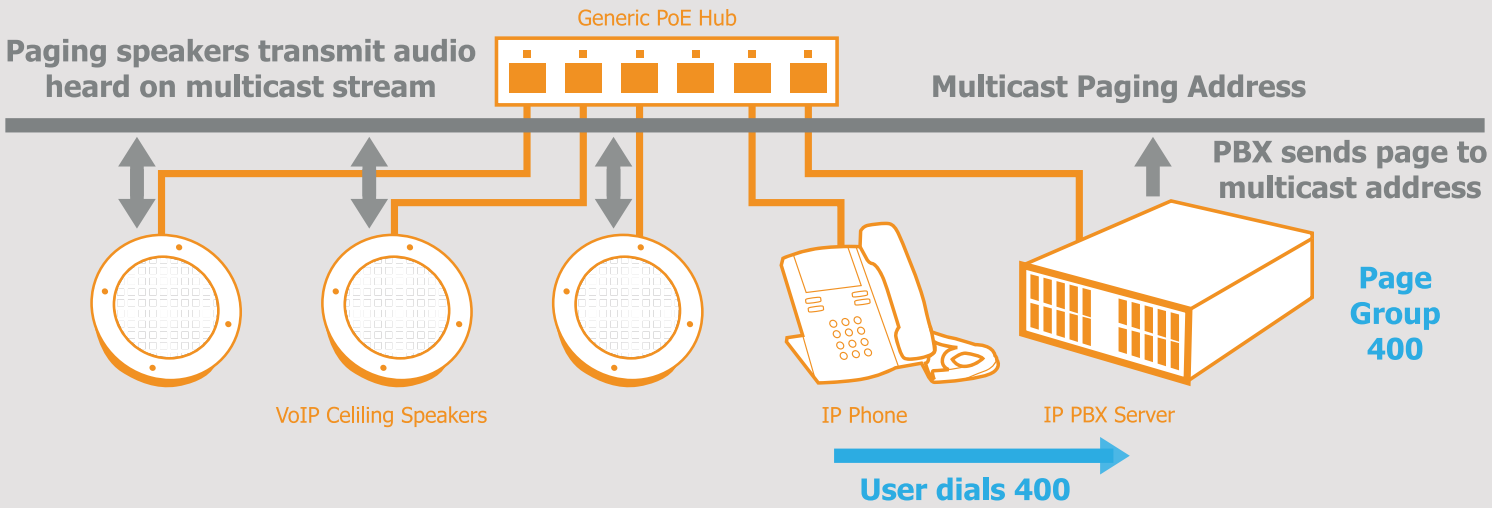
Multicast paging achieves the same outcome as unicast paging but delivers each page much differently. Multicast paging is based upon a one-too-many architecture. In most multicast paging environments, administrators will specify a single multicast paging address in the IP PBX setup. They will then configure each paging endpoint such as an IP Phone, overhead speaker, or amplifier, to "listen in" on that multicast address.

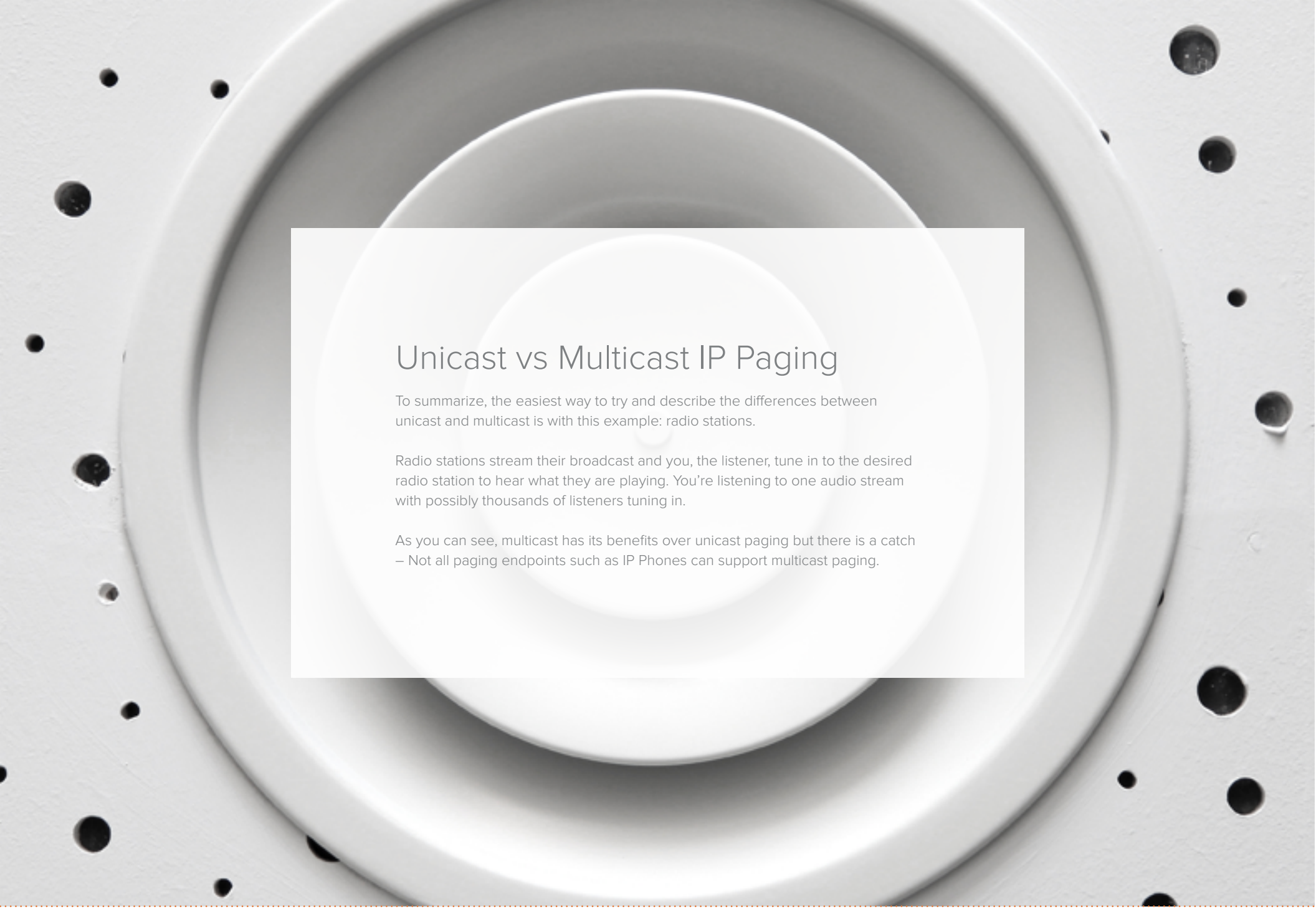
When a user initiates a page in a multicast scenario, the page originates from the IP PBX just like a unicast page would. However, the PBX only sets up a single SIP and RTP audio path to the multicast paging address.

The IP Phones or other paging endpoints are always "listening" to this address and when RTP packets or audio is heard, the phone or paging endpoints merely play that audio stream.

A paging group that contains 500 users, for example, could very easily receive a page using multicast because the PBX only makes 1 SIP call for its 500 users in the multicast page group. This preserves and protects the IP PBX's CPU and system resources to maintain an efficient operating environment.

Typical Installation



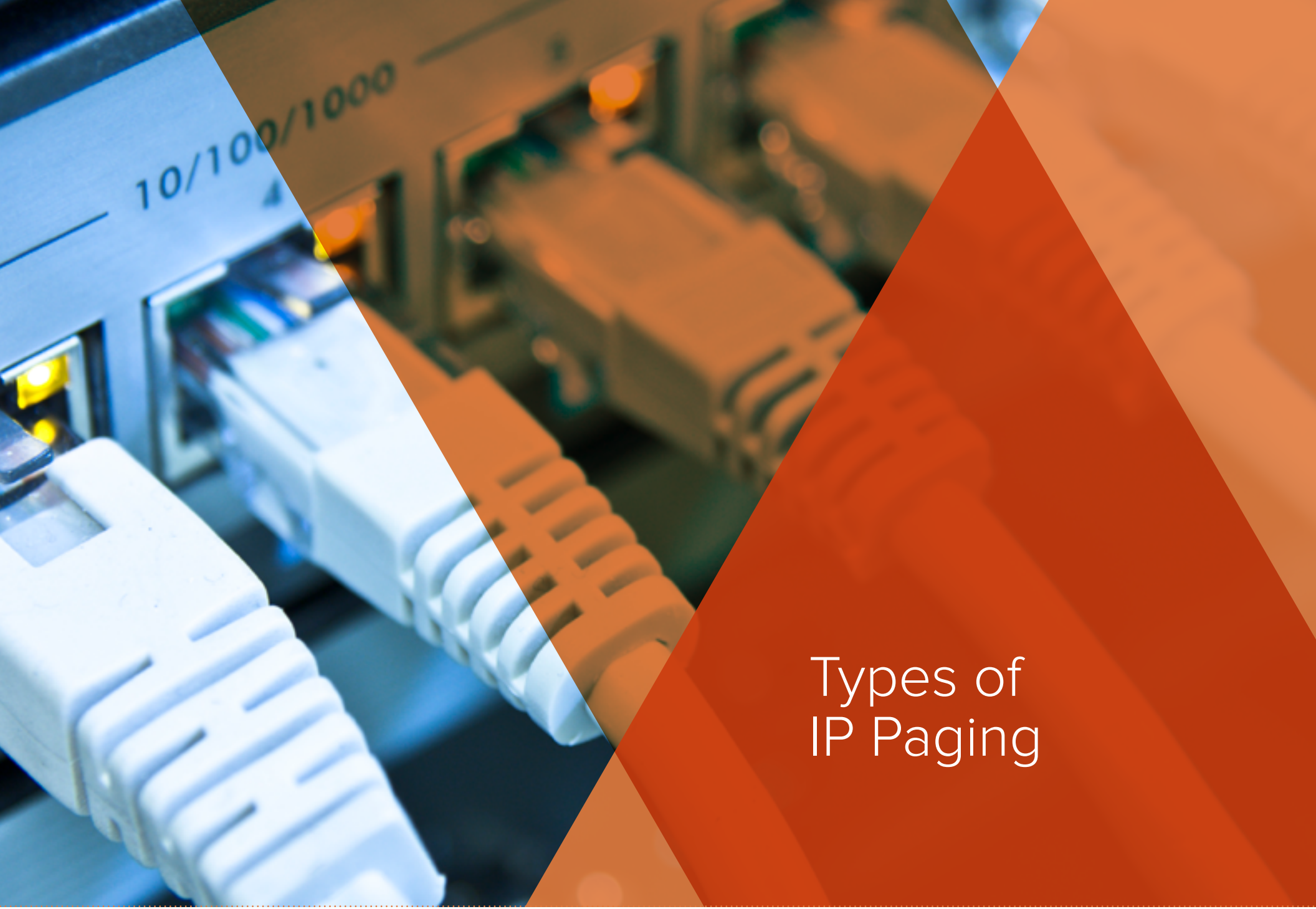


Unicast vs Multicast IP Paging

To summarize, the easiest way to try and describe the differences between unicast and multicast is with this example: radio stations.

Radio stations stream their broadcast and you, the listener, tune in to the desired radio station to hear what they are playing. You're listening to one audio stream with possibly thousands of listeners tuning in.

As you can see, multicast has its benefits over unicast paging but there is a catch – Not all paging endpoints such as IP Phones can support multicast paging.



Types of IP Paging

We've talked about the two methods that IP paging is delivered in:

1. Unicast IP Paging
2. Multicast IP Paging

And within those two methods there are two types of paging that can be performed:

1. Desktop Paging
2. Overhead Paging

Desktop Paging

The first type of paging is desktop paging. Desktop paging is exactly what it sounds like, paging at the desktop.

This usually involves an IP Phone that supports paging. During a desktop page, the IP PBX will usually be configured for a page group or groups depending on the scenario, and a user will simply dial into that page group to initiate the desktop page. The SIP extensions of the users inside that page group in the IP PBX are then desktop paged either via a unicast or multicast stream.

Desktop pages are delivered directly to the IP Phone triggering it to immediately go off-hook and deliver the page through the speakerphone. So at bare minimum, from a hardware standpoint, you need an IP Phone that supports a speakerphone which is about 95 percent of the IP Phones on the market today. If you are unsure, please don't hesitate to ask one of our VoIP Experts.

Desktop Paging Configuration & Options

Desktop paging can be configured to "play a beep" first before the page comes through the speaker to alert the user that a page is being delivered. Also, pages can be configured to interrupt a user on a call or wait until the user has completed the call.

In situations where a page will interrupt a user during a phone conversation, the party that this user is speaking with will not be able to hear the page. However, this may cause a distraction to all users on the conversation.

Administrators configuring the page groups must be aware of the users inside the page group as well as the importance of each page. For instance, a car dealership may opt to mute the page until the salesman or parts department is off the phone.

Conversely, a hospital may opt to interrupt the call because they are delivering time sensitive information.

Most IP Phones and SIP Based IP PBX's support desktop paging. Please be aware that not all SIP DECT cordless handsets support paging (as they don't have the ability to go-off hook automatically and/or don't support a speakerphone).

If you are unsure, please confirm with your VoIP experts first!

Overhead Paging

The second type of IP Paging is overhead paging. Great advancements have been made in this department over the past few years to cater to new IP based overhead paging solutions.

Companies such as CyberData, Valcom, and Advanced Network Devices (AND) have products such as SIP-based overhead ceiling speakers, intercoms, loudspeakers, horns, and clocks. Most of these products are powered via POE (Power over Ethernet) so installation is simplified with one (1) cable.

There are also options for Wi-Fi connectivity but please keep in mind that even without the hassles of wires for data/voice transfer, the device itself still needs power which may require an electrician to hard wire these units.

Also, configuration is very easy as most of these endpoints are based upon SIP standards and are easily configured with a SIP extension (just like you would with an IP Phone) via the products web GUI (graphical user interface) configuration. Simply add these endpoints SIP extensions to a new or existing page group on your SIP PBX and dial the page group extension.

Overhead Paging Audio

Audio is transmitted through the overhead speaker or amplifier horn combination. For applications that require a louder horn, such as a warehouse or manufacturing facility, the CyberData Loudspeaker is used for these noisy environments which adds more decibels to the volume level allowing pages to be heard properly.

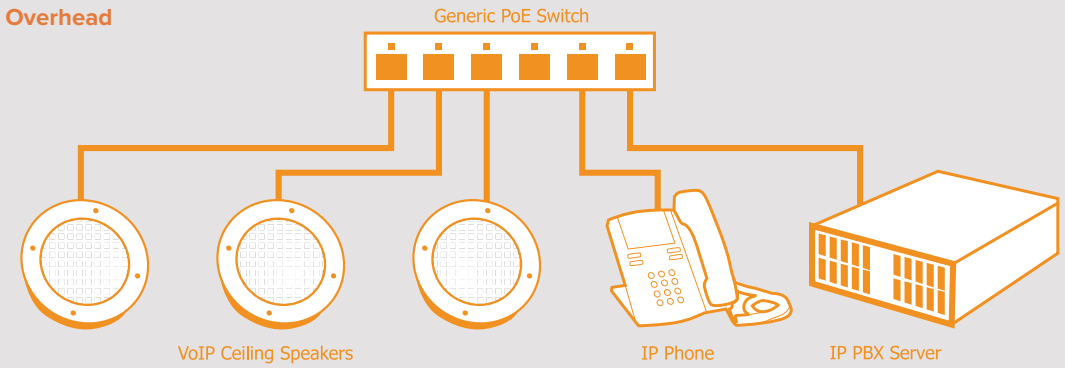
Of course, mounting options may be of concern so CyberData offers a few types of mounts for their overhead paging speakers such as:

- Wall Mounts
- Flush Ceiling Mount
- Wall Mount With Clock (nice for hallways in a hospital or school).

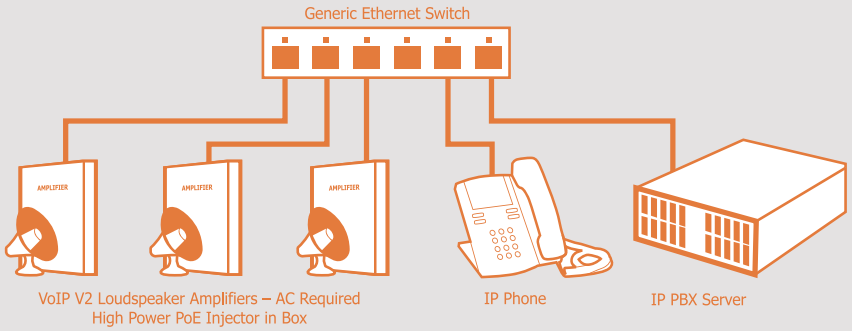
On the next page, you will find two illustrations (thanks to CyberData) on Overhead Paging that depict how each type of overhead paging endpointinterfaces with an IP PBX.

Overhead Paging

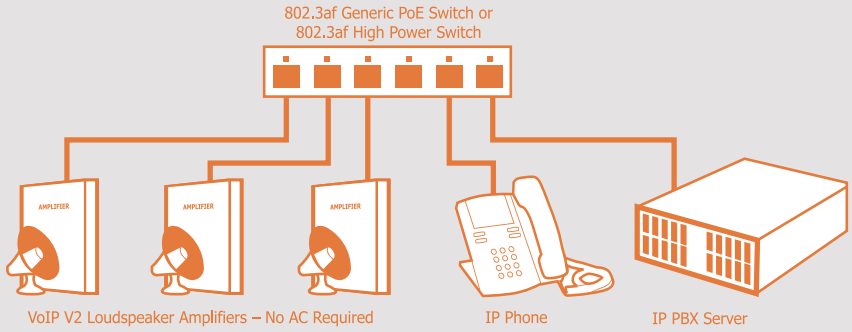
Typical Installation



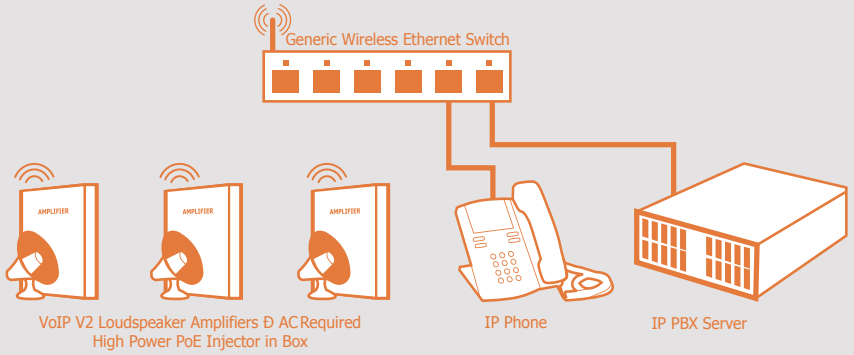
Typical Installation – AC Version (Part #011095)



Typical Installation – PoE 802.3af (Part #011097)



Typical Installation Ð Wireless 802.11g (Part #011096)



*For AC wiring, use a qualified electrician.

IP Enabling Your Analog Paging System

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IP Enabling Your Analog Paging System

As mentioned earlier, your traditional zoned paging systems are proprietary, inflexible, not easily managed, and won't mesh well with your new IP PBX.

Now, you could fully replace your zoned paging system with an IP Paging system, but that requires additional budget and time. The costs of replacing this equipment may be high because the overhead of installing this new equipment may require:

- New cable runs
- New mounting hardware
- Possible modifications to electrical runs

These additions and modifications may not be possible so incorporating existing paging systems into an updated IP-based solution is a must.

Breathe New Life Into Your Existing Equipment

Does your analog paging system still work? Do you want to continue getting a return on that investment but gain some new features like, flexible zoning and enhanced speaker capabilities?

Enter the IP Paging Gateway!

A relatively simple device, the IP Paging Gateway is similar in form and function to a VoIP adapter or VoIP gateway.

What is an IP Paging Gateway?

An IP Paging Gateway enables access to existing paging speakers through a VoIP phone system. The interface is designed to use an existing analog zone controller with a Telephone Answering Machine (TAM) interface and can support paging for many zones from a VoIP phone.

Using an IP Paging Gateway

An IP Paging Gateway is simple to set up. Using the Ethernet port on the IP Paging Gateway you connect the gateway to your switch.

Once the IP Paging Gateway has an IP address, you can use the web based configuration to set up the basic settings. You then connect your existing zone controller to the FXO port on the gateway. It is a very simple installation and makes for a clean solution.

Incorporating a New VoIP Solution

A common experience is when an analog paging user installs a brand new IP PBX with new IP phones and they now want to incorporate (converge) that paging system into the new VoIP solution.

Installing an IP Paging Gateway

Like any gateway does in the IP world the CyberData Paging Gateway integrates 2 different networks together. Most commonly, this is done over a voice circuit where voice gateways connect to standard RJ-11 analog POTS lines or analog telephones and allow communication to an IP network or IP based PBX. The same is true for the CyberData Paging Gateway. However, this gateway is used to connect older legacy analog paging systems to an IP network.

To do this, CyberData uses an FXO port. Just like in standard telephony, FXO (Foreign Exchange Office) compliments FXS (Foreign Exchange Station) devices. This FXO port on the paging gateway will interface with an existing TAM interface, Zone controller, or other legacy paging equipment via a standard analog FXS port.

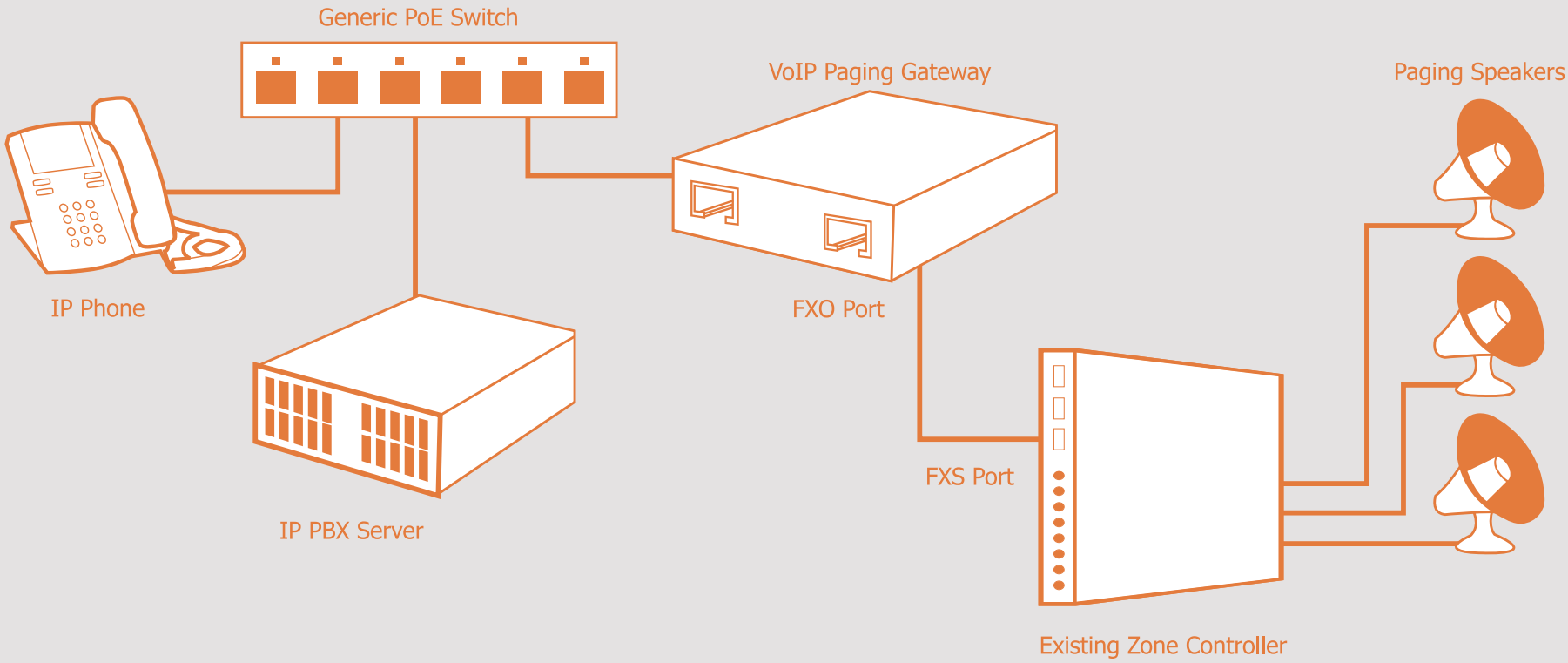
Remember, FXO uses FXS signaling and FXS uses FXO signaling. Once the communication and connection is made between the existing paging equipment with the analog FXS/FXO combination, the gateway now merely acts as another SIP extension on the IP PBX and communicates with the IP PBX over the IP network via its LAN port. All administrators need to do is simply configure a page group on their IP PBX, register the gateway via its designated SIP extension to the IP PBX, then add that extension to the page group.

When users dial the page group extension, the IP PBX will ring the SIP extension registered to the paging gateway and it will send the page to the analog paging equipment attached to it.

IP Enabling Your Analog Paging System (cont.)

Here is a good look at how this solution works:

Typical Installation – FXO



IP Enabling Your Analog Paging System (cont.)

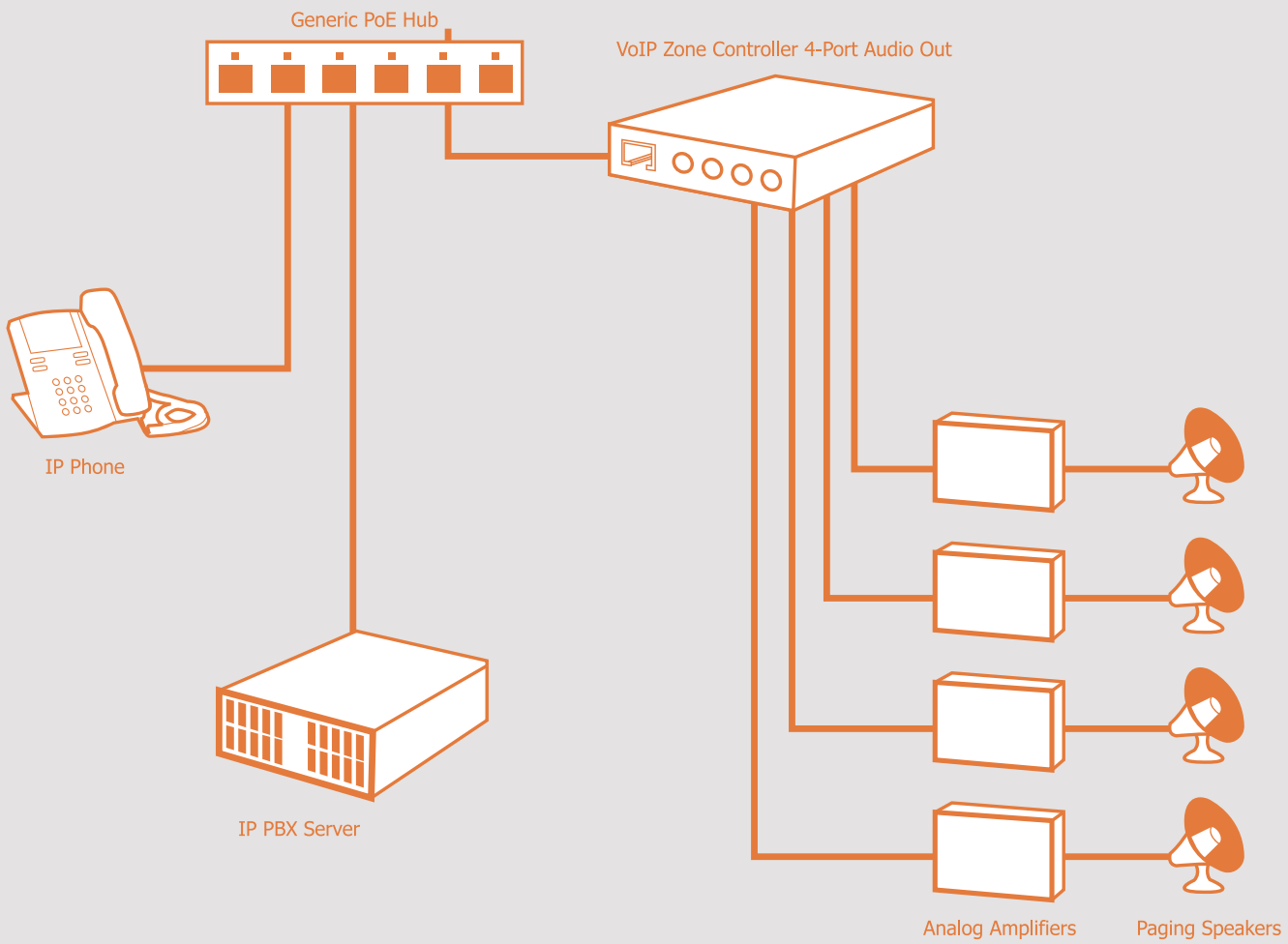
Zone Controller
The second device used in the paging world to incorporate older analog paging systems with new IP PBX's is the CyberData Zone Controller.

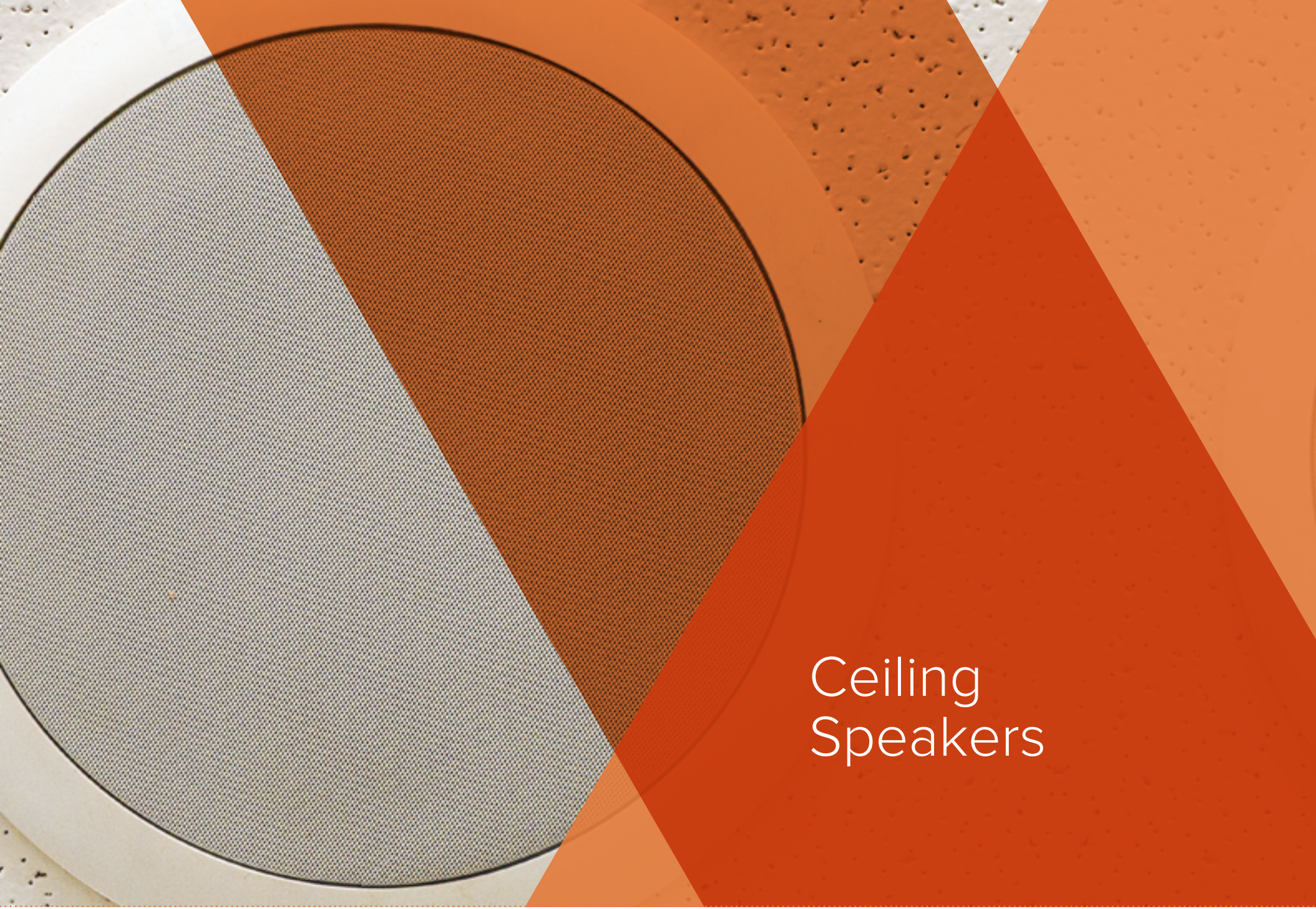
What is a Zone Controller?
A VoIP Paging Zone Controller enables access to existing paging speakers through a VoIP phone system. It is designed to use a standard paging amplifier with audio inputs and the CyberData model supports paging up to 15 zone groups from a VoIP phone.

Connecting a Zone Controller
Unlike the paging gateway, the zone controller contains 4 standard audio out ports which are used to connect to existing analog amplifiers. In turn, speakers or horns would then be connected to those amplifiers.

Once the standard audio connection is made between the zone controller and existing amplifiers, the zone controller will communicate to the IP PBX via its LAN port over the IP network. The zone controller contains 4 page zones and allows for up to 15 zone groups.

Typical Installation





Ceiling Speakers

Another component of an IP paging system, not to be overlooked, are ceiling speakers. There are two kinds:
- Analog Speaker
- VoIP Speaker

With their small footprint and low height, ceiling speakers can be discretely mounted almost anywhere.

Analog Ceiling Speaker
The CyberData V2 Analog Speaker is an option for the CyberData V2 Standard speaker that supports an amplified audio output for a second analog speaker.

When connecting this analog speaker to the CyberData V2 IP speaker, the total speaker wattage is the same. However, by connecting this analog speaker, additional coverage can be realized.

This analog speaker can be mounted with the same mounting hardware option available for the IP versions of CyberData speakers.

VoIP Ceiling Speaker
CyberData VoIP Ceiling Speakers are PoE (Power over Ethernet) enabled and will hook up easily to new and existing installations.

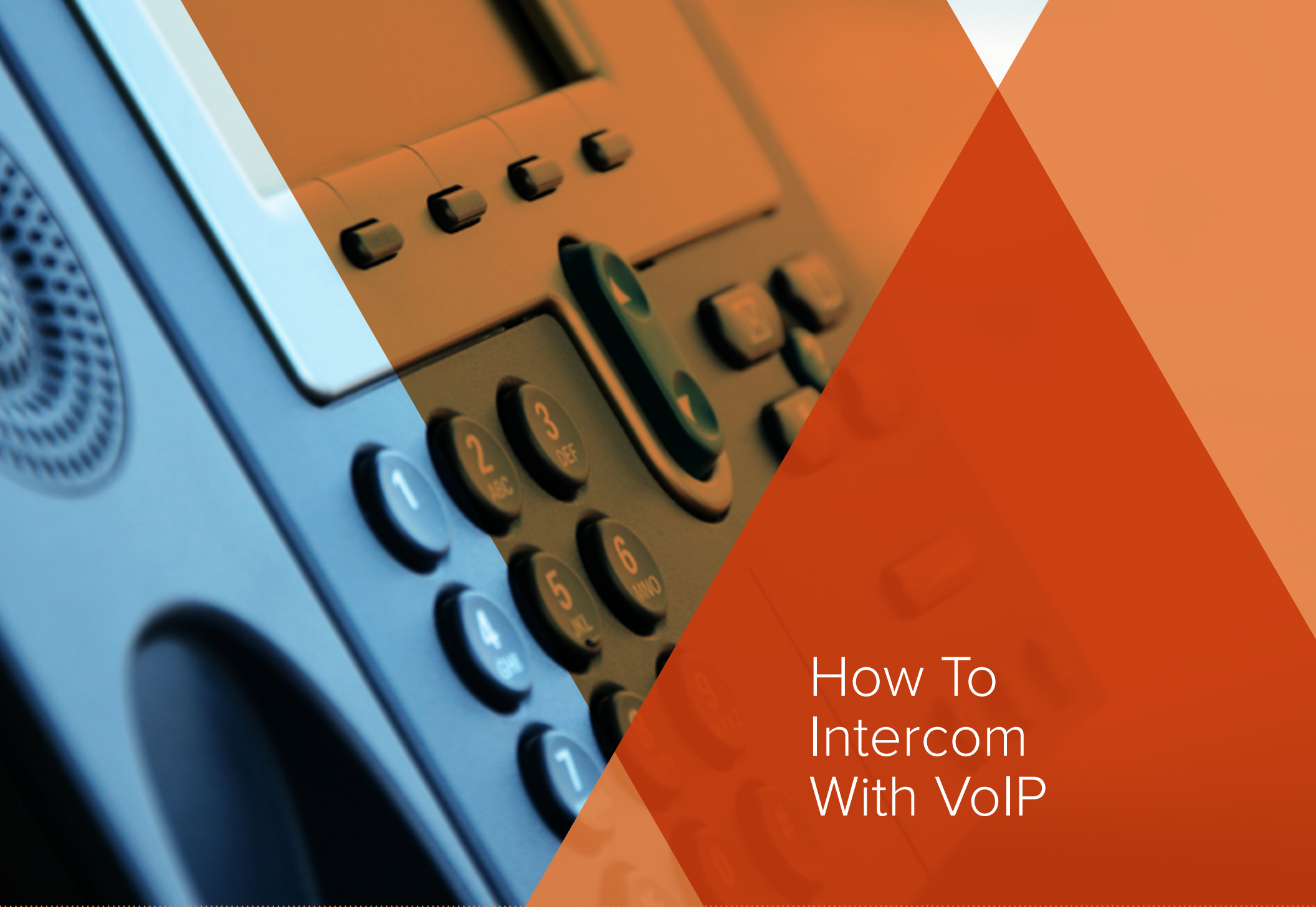
The Advanced Network Devices IP Speaker model features a two-way loudspeaker that, for example, in an open-room setting allows for clear two-way communication during event notifications with its full-duplex voice operation. VoIP speakers are compatible with most SIP-based IP PBX or in a non-SIP environment, the speakers can broadcast audio through multicast.

VoIP speakers offer:
- Web-based configuration
- Web-based firmware upgradeable
- PoE 802.3af-enabled (Powered-over-Ethernet)
- Network and external speaker volume control
- Ability to drive external speakers for greater coverage

Speaker Chain
Valcom, CyberData, and AND all offer the ability to chain an analog speaker off of an IP speaker to expand coverage for less money.

Speaker Calculator
Use the Speaker Calculator, based on coverage area and ceiling height, to determine the approximate number of speakers needed for any given space.

The speaker calculations are based on equal-sided, unobstructed rooms. For elongated rooms like hallways or for obstructed rooms, additional ceiling speakers may be required.



How To Intercom With VoIP

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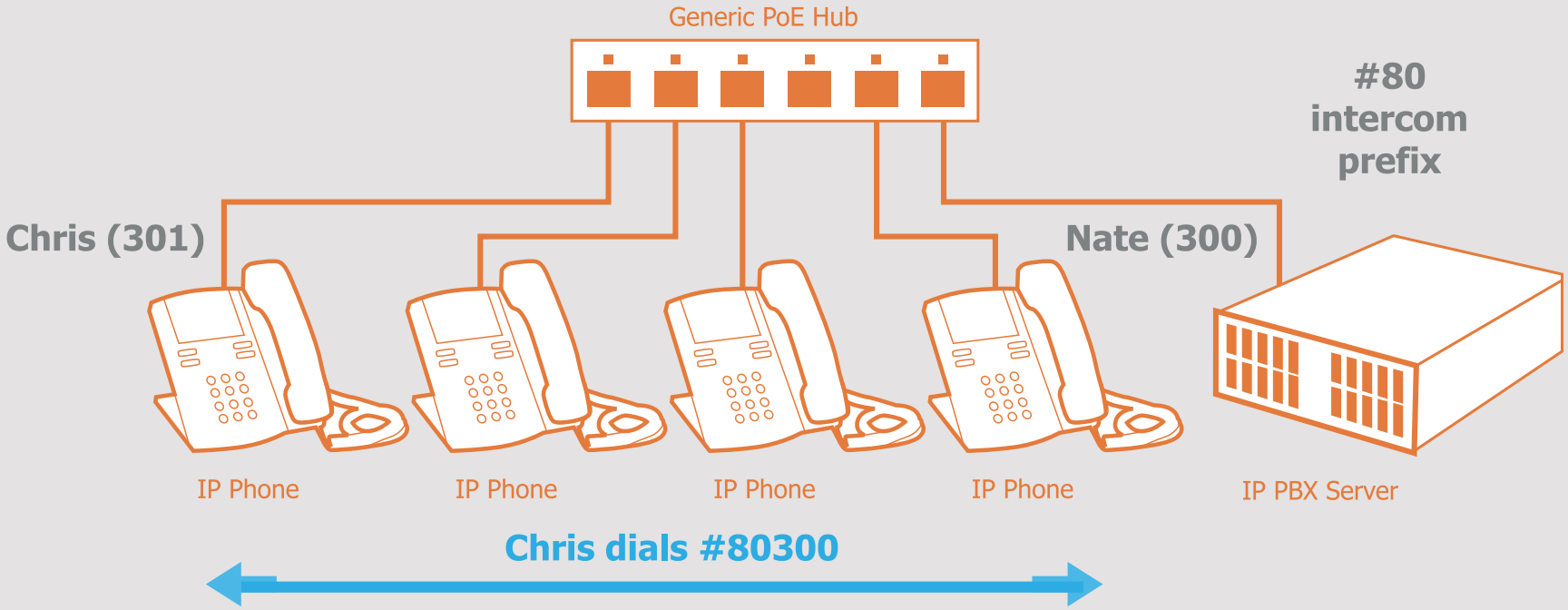
What is an intercom call?
Intercom differs from paging because in an intercom call, a single user will intercom another user (or endpoint) and essentially set up a point-to-point SIP call. Only, when the recipient gets an intercom call, the phone does not ring but rather goes off-hook to speaker and audio is transmitted between the two parties. A single beep tone can also be configured to play to the user receiving the intercom before audio is transmitted to let them know that they are being alerted via intercom.

In today's VoIP world, most IP PBX's have the ability to setup intercom between two endpoints. This can be achieved in a few ways.

Intercom Calling – Method #1
The first method is to configure an intercom prefix. Most solutions that are Asterisk® based already have this prefix set-up, but you can change it if need be. After an administrator determines the prefix, users can simply dial that intercom prefix, then dial the SIP extension they wish to intercom, and then press "Send" from their IP phone.

Let's say, for instance, that our dialing prefix for sending an intercom was #80 and Chris (me) wanted to intercom Nate who is at SIP extension 300. All I would need to do is dial #80300 (intercom prefix + SIP extension) and then press "Send" from my IP phone. Nate's phone will then beep, and then immediately go off-hook to speakerphone mode and the transmit the audio message between us.

Keep in mind with this scenario that most IP phones must be configured to receive intercom calls and also go off-hook automatically. Here is a good example at how this would look:



Intercom Calling – Method #2
The second method of intercom calling is to use the same intercom prefix as noted before but this time, our intercom device will not be a desk phone but either an indoor or outdoor call button with intercom functionality.

For example, the Cyberdata VoIP Indoor Intercom is a door entry device with a ringer button and Valcom offers a SIP door intercom.

These devices are configured very much like a SIP phone as they are merely another SIP extension on the VoIP PBX. They are connected to the IP network via Cat 5 and most support standard PoE to simplify wiring for the end user or installer.

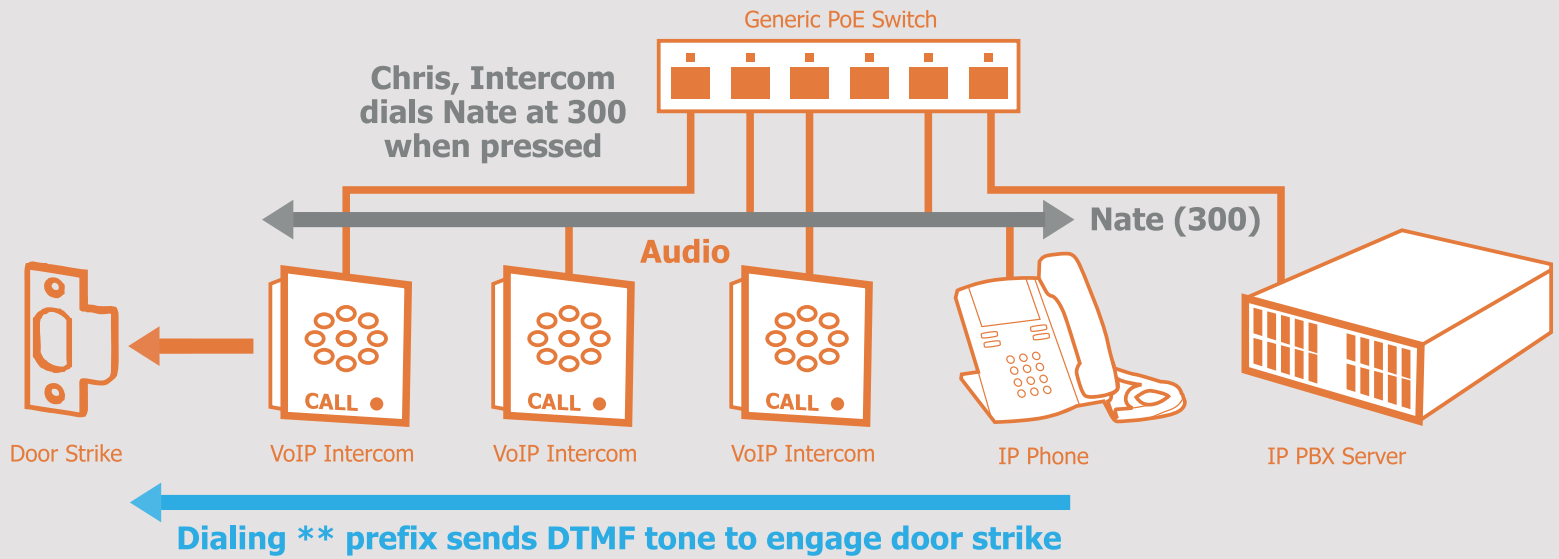
Once the intercom is properly registered to the IP PBX via its web GUI configuration, the administrator will then set a specific SIP extension for this device to automatically intercom. In most cases, these can be users such as the front desk in a hotel or school, a security office, or anyone permitting users inside a building.

Residential Intercoms
We have also seen a huge uptick in residential users and apartment style setups use these devices in their deployments. After these are installed, users engaging with the intercom device will simply press the CALL button (no dialing is necessary) and the intercom will automatically intercom the SIP extension which is configured to dial and establish two-way audio between the two users.

For instance, Chris is an employee at VoIP Supply and wishes to access the building after-hours where the security watchman Nate is working. Chris presses the outdoor intercom on the outside of the building and immediately starts communicating with Nate at his SIP extension, 300. Nate recognizes that it is Chris and then sends a DTMF (dual-tone multi-frequency signaling) signal back to the intercom device to engage with a door strike which unlocks the door for Chris.

Here is a good look at how this would work:

Typical Installation – Door Entry/Access Control



Using Same DTMF Method Across All Devices

The ** (listed in the image on the previous page) prefix can also be configured on the Intercom unit via its web GUI configuration. The only requirement is that the same DTMF method is being used for:

- The Intercom Unit
- The IP PBX SIP Extension for the Intercom Unit
- And the IP Phone communicating with the both the IP PBX and the Intercom

For instance, if an admin chooses to use the DTMF method RFC2833, then the Intercom, SIP extension, and the IP Phone must also use the RFC2833 DTMF method.

What Happens if the Same DTMF Method is Not Used?

If one of these devices is not using the same DTMF method as the others, for example, the IP phone is set to use Inabnd or SIP INFO DTMF method type then when the user dials** to engage the door strike neither the IP PBX nor the Intercom will know what to do since they are “talking” on the RFC2833 DTMF method.

The easiest way to put it is this: If RFC2833 speaks English and Inband speaks Chinese then in most cases these two parties will not be able to understand one another.

Conclusion

Paging may be an afterthought for a lot of businesses and they certainly aren't the sexiest systems to talk about – loudspeakers, ceiling speakers, intercoms, gateways, etc.

However, they can offer substantial benefits to schools and businesses. And if you have an existing analog system, there are solutions available to converge them into your IP network to gain even more functionality and efficiency while avoiding the cost of a full-scale replacement.

Need Help?
We here at VoIP Supply appreciate the time you invested in Learning More about IP Paging Systems and hope that you have found this content helpful.

In closing we'd like to once again extend you our services here at VoIP Supply. Since 2002, VoIP Supply has helped over 100,000 people just like you create, deploy and maintain a VoIP solution – adding you as a customer would be a great privilege.

After leaving this guide to further dive into the process of purchasing an IP Paging solution, if you ever find yourself confused, frustrated or simply in need of expert advice, please do not hesitate to give us at a call at 800-398-8647 and we will do our best to give you honest, accurate and helpful information that will help you make the right choice.

Thanks again for your time – the VoIP Supply team.

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