

Voice over IP
in the
Contact Centre

Introduction

The contact centre has become a fundamental, strategic business tool for the enterprise. Contact centres are instruments that influence customer satisfaction, and can be significant factors in the reduction of customer churn. In today's competitive environment, enterprises must look for new ways to improve customer service in order to differentiate themselves from the competition, improve customer service, and grow their customer base.

Businesses are always looking to increase margins by reducing costs. Having a contact centre is only a start. Enterprises must use innovation within their contact centres, expand their traditional methods of customer interaction, and find better ways to service their customer base. Voice over IP is one technology that enables a contact centre to resolve some of these issues. You should evaluate the technology to the extent it leads to your business goals. It is important that if you considering Voice over IP for your contact centre, you understand both the benefits and challenges with Voice over IP.

This paper will define Voice over IP, the benefits it has when used in a contact centre, along with some of its potential challenges and issues.

What is Voice over IP

Within many environments voice is carried over circuit switched based networks. It is not carried over the same network as email, chat, fax, and other data elements.

Voice networks include lots of hardware and circuits, and require a dedicated path for each connection. While a call is occurring, there is no other activity on that circuit, and for each simultaneous call a circuit is required. This means that an enterprise must plan its voice network based on peak volumes.

In the late 1980's, companies began investing in a technology, Internet Protocol (IP) that began to change the way phone calls were handled within the contact centre. The Internet itself is a huge IP network. In addition, corporate LAN and WAN's that link systems within an enterprise are IP networks. With IP, data is carried across these networks in segmented packets.

Internet Protocol allows voice to be transmitted, along with data, on a single data network. The digitised voice is considered data that needs to be transmitted. IP is not only the protocol, but also the set of rules that enable what is known as Voice over IP. Voice over IP is not Voice over the Internet. Voice over IP is Voice over the Internet Protocol.

Voice travels over the data network in small packets that are reassembled at the receiving end of the contact. With Voice over IP, the voice channel is carried over the IP network along with email, chat, fax, and other data rather than through a separate circuit based switched network. Voice over IP enables the convergence of voice and data within the enterprise.

Traditionally, data networks were not designed to support the transmission of time-sensitive information, such as voice. Voice quality as perceived by the end customer should not vary based on the technology used within a contact centre. However, there are many factors with Voice over IP that impact voice quality. These factors include compression, latency, jitter, and packet loss. Each of these items is detailed out later in this paper.

These voice quality issues have presented challenges for the vendors who are now supporting Voice over IP. They must ensure that the quality of the voice contact to the end customer remains the same as with the traditional circuit based network.

Voice over IP in the Contact Centre

There are several applications for Voice over IP in the contact centre. For example, agents can use IP based phones. With IP based phones the data is sent to the agent in packets and the phone brings the packets together to form a voice call. These IP phones can be physical hardphones (physical phone) or softphones (PC based application).

A second application of Voice over IP in the contact centre is the transmission of voice calls within the contact centre via the company's WAN/LAN. This use allows phone calls to be received and dialled from one location and transmitted to agents in another location without incurring any additional toll charges. A call can be routed to any agent tied to the company WAN/LAN.

When various sites within an enterprise are connected via an IP WAN, calls between the sites can be transmitted via IP. This allows for a call to be sent to an agent at one site and then transferred to another agent at another site, without incurring any circuit-based costs. However, there may be additional costs due to the bandwidth required on the enterprises LAN/WAN.

Enterprises can also send and receive calls over the public Internet. A number of carriers today are offering interfaces via IP at a significant savings over the PSTN network.

Contact Centres that use Voice over IP will have networks that are easier to manage, and the overall expenses of their contact centres may be reduced. Using Voice over IP technology eliminates a very costly factor in the contact centre, a separate circuit based network for voice traffic.

Keep in mind that Voice over IP is a technology, not a business plan or tactic. Companies need to look at the technology in terms of how it will assist them in their corporate business goals.

Types of Deployments in the Contact Centre

There are two different types of deployments of Voice over IP in the contact centre. One possible deployment is a pure IP solution within the contact centre. This solution turns a call centre into an IP-contact centre where all forms of communication, including voice, are treated as data within a single enterprise network.

The second type of deployment of Voice over IP in the contact centre is through a hybrid solution. Hybrid IP solutions are designed to bring gradual changes to traditional contact centres and provide a technology infrastructure where the contact centre can be slowly migrated to IP. For example, if a contact centre wants to utilize some remote agents, those agents can be IP based, while the other agents are circuit-based. Hybrid strategies reduce the risks for contact centres while allowing them to take advantage of some of the benefits of Voice over IP. As stated before, Voice over IP is a technology. It should be evaluated to the extent it leads to the goals of an enterprise.

There are several types of equipment utilized in an IP Contact Centre.

IP-Cads and IP-PBXs.

- These applications perform the same functions as a traditional circuit based ACD and PBX. This includes dialling, skills based routing, DID, conferencing, voice mail, etc.
- The IP-ACD is software versus hardware. The hardware that runs the software can be standard or proprietary.
- Very few switch vendors have developed pure IP-ACD/IP-PBXs. Rather, most switch vendors have developed IP-compatible products within their PBX and Cads. These are hybrid solutions. For example, many vendors IP-enable their most recent version of their PBX by adding a plug-in card to the system or an IP Gateway. These hybrid products can route circuit switched calls to agents' extensions and packet-switched calls to their PCs or IP-Phones.
- Hybrid products allow a contact centre to migrate at its own speed, based on business needs, to Voice over IP. A contact centre can leverage the benefits of IP without converting its entire contact centre to Voice over IP.

Voice over IP Gateway: This is a device that acts as a converter between an IP network and a TDM network. A gateway takes traditional circuit switched (TDM) calls, performs echo cancellation, compresses the speech, assembles IP packets and delivers the voice via an IP interface. For example:

- Digitised voice coming from the PSTN for inbound calls is converted to IP packets for a centre with IP-Phones.
- Digitised voice coming from the PSTN can be converted to IP packets for delivery to the agent's IP phone.
- Data coming from IP phones is translated to non-IP in order to dial calls out on the PSTN.
- Migrating to a Voice over IP Gateway is a fast and effective means to interface to a PBX/ACD for a Voice over IP deployment.

Benefits of Voice over IP in the Contact Centre

There are many benefits of IP that can be realized by contact centres. Some of these benefits are outlined below.

New Means of Communication

Voice over IP enables end customers to initiate a live voice conversation with an agent over a dial-up Internet connection, using a multimedia PC and a microphone, without having to disconnect from their ISPs. The call is transmitted on the data network but is received by the contact centre as a voice call.

Remote Agents

IP offers flexibility for a contact centre in terms of agent location. Multi-site interactions are available to contact centres today. However, traditional circuit based technologies limit the interaction between sites. IP allows for the creation of a virtual call centre, making the locations of the agents irrelevant. Wherever agents work, they will appear as though they are at the main site. When the ACD functionality is centralized, IP allows contact centres to be tied to the enterprise network by an IP network and become branches rather than individual centres. This will allow the activities of a contact centre to be diversified, creating a virtual contact centre.

Note that this activity can also occur in traditional TDM networks, but with IP, the cost for creating these virtual contact centres is much smaller.

Being able to utilize remote agents has many benefits such as:

- Opening up new contact centres in other regions where the cost of labour and/or facilities may be lower.
- Fill in off hours for contact centres with remote agents who are located in different locations, and will even enable them to work from their home.
- Opens up the labour pool such that the right agents can be hired, regardless of where they are located. This expanded labour pool for your contact centre is available through telecommuting, working at branch locations, and working at contact centres around the world.
- Allows for clean backup plans. For example, if a contact centre must close down due to a local holiday, remote agents can be utilized.
- Improved customer satisfaction since you are now hiring the best agents to staff your contact centre.

Although agents are located potentially anywhere when using IP, the telephony costs for the outbound calls and the inbound calls are based on where the system is located, not where the agent is located.

Please note that there are downsides to having dispersed agents. Some of these downsides are addressed later on in this paper.

Virtual Contact Centres

Some contact centres have taken the benefit of remote agents to the extreme by removing their actual contact centre facilities of a contact centre so that all agents are located remotely. Datamonitor defines a virtual call centre as: Several groups of agents in geographically separate locations being treated as a single entity for call handling, reporting, managing, and scheduling. The only facilities required are those that will house the hardware. Otherwise, both the agents and the supervisors can be located remotely from each other.

Through the use of IP, contacts can be routed to the agents, along with the agent-hit screens, based on the business rules set up in the contact centre software. In addition, IP allows the agents, the business rules, and the system to be managed and administered remotely.

To the end customer who is contacting the contact centre, the agent's location is not revealed. For the customers, all that is important is the service they receive when they call the contact centre.

The benefits of a truly virtual contact centre include:

- **Reduced staff recruitment:** When agents are allowed to work virtually, they benefit by having the flexibility to work from home offices, versus agents at other contact centres who are required to work from a designated office location.
- **Cost savings:** Contact centres no longer have to worry about the costs to rent and maintain office buildings. They still need to account for the bandwidth requirements as well as the agent equipment.
- **Enhanced Customer Service:** Since contact centres can now hire the most skilled agents, they will enhance their level of customer service.
- **Reconfiguration:** Agents can be quickly added and removed with Voice over IP.
- **Scalability:** A virtual contact centre is much more scalable since scaling is based on network bandwidth versus facilities.

There are some drawbacks that come with virtual contact centres. For example, training and coaching becomes more difficult. In addition, a contact centre may lose some of the productivity benefits of having agents located together such as general morale and motivation, on site learning, and easier supervision of the agents.

Reduced Administration Costs

Administration through Voice over IP allows supervisors to manage and monitor agents in contact centres in geographically dispersed locations. This enables supervisors to create universal routing business rules and reports that manage the contacts independent of the location of the agents and independent of where the contact came into the system. For example, contacts could be received via IP devices around the world, managed by one supervisor, routed to agents located around the world, and consolidated into one virtual contact centre. As stated above, agents can be located remotely through circuit-based networks. However, the cost for maintaining these circuit-based networks to support remote agents is much more expensive than if those agents communicated via Voice over IP.

Reduced Operational Costs

IP based contact centre solutions typically save upwards of 30% on operational costs. Savings are realized through the elimination of traditional PBX equipment, its maintenance, the cost of additions, moves and changes as users come and go. Further savings are realized as IP based contact centres utilize one physical network and eliminate the dual “telecom” vs. “datacom” specialized staffing.

Since IP is structured upon standards, contact centres that are IP based can add applications from distinct vendors without impacting other applications that run on the same network. In this situation a contact centre would need to ensure that there is enough bandwidth for handling additional applications.

Reduced Telephony Charges

Virtual contact centres realize additional savings through the application of “toll bypasses,” which transmit inter-office calls via Voice over IP utilizing the corporate WAN. Although toll costs have gone down significantly for calls within North American, the toll bypass telephony savings are substantial for international routing.

Contact centres that utilize sites in different countries can potentially interact with each other for free. Dialling can be set-up at the least expensive locations, and the calls can be routed, via the IP network, to an agent located at another site. In addition, inbound calls can be received from a system in one location and then routed to agents in a geographically dispersed location.

IP based trunking is becoming more widely available and is an avenue for further savings. Some of the major Long Distance carriers currently offer or plan to offer trunking via IP as a significant savings over traditional T1/E1 trunks to the PSTN.

Technical Challenges of Voice over IP in a Contact Centre

Voice is a mission critical application, as the quality and reliability of the telephone is extremely important to end-users and to contact centres. Although data traffic is growing at a faster rate than voice traffic, the majority of contacts will still occur via voice in five years. In addition, end-users are very intolerant when it comes to voice since it has traditionally been carried on highly reliable dedicated networks. End customers expect the same voice quality as they have always received. End customers should not be able to distinguish whether their call is being carried over an IP network or a traditional circuit based network.

Many of the early experiences with VoIP were poor. In the recent past though, there have been large advances in algorithms, protocols, and routing techniques within VoIP.

This section will outline the technical challenges for Voice over IP in a contact centre, followed by tactics to help overcome these issues.

Latency

The process of compressing voice and creating IP packets inherently introduces delay or latency in the speech path. Further latency occurs with voice travelling over the data network as it traverses the various routers and switches within the network.

Fortunately, most people cannot perceive latency less than 200 milliseconds and acceptable conversations can take place with latency figures up to 500 milliseconds according to many vendors of Voice over IP technologies.

Many of the technical challenges below impact the latency in the speech path. It is critical that the technical issues below are evaluated when considering a migration path to Voice over IP.

Packet Loss

Packet loss occurs in networks due to congestion. Voice as a payload is very sensitive to timely delivery and/or loss. The goal within a network that has Voice over IP traffic is to reduce the loss as much as possible. There are various ways to do this. For example, one option is to make the packets a smaller size and/or ensure that within the network, the voice packets have higher priority over the other data packets.

Jitter

Jitter is the amount of variation in time that packets are delivered. Excessive jitter (or jitter errors) makes voice difficult to understand. The way jitter errors are controlled is to introduce buffering in the packet delivery through a jitter buffer. The larger the jitter buffer, the more resistant a systems will be to jitter. However, the addition of jitter

buffering increases system latency, potentially causing unnatural delay in delivery of voice. The trade-off for users is that they can either have poor audio quality with less latency or cleaner audio with more latency.

Legacy Investment Protection

Another key issue with Voice over IP is the existing investment in the telephony network. Many contact centres have made large financial investments in telephony equipment and ACD vendors have just recently began to offer hybrid solutions. In addition, traditional ACD vendors may be tempted to protect their own investments by slowing down the migration to IP.

Security

Providing a secure connection in a Voice over IP environment is a challenge due to security complexities and the issues with quality of service that were just outlined. As with all data networks, hacking can be a problem.

When an enterprise opts to send voice over the public Internet, the potential for security breaches exists. There are technologies that can minimize the security breaches such as encryption, but they may add delays that lead to quality of service issues. Company's Network Administrators need to evaluate ways to tighten the security of their networks to account for the fact that it will no only be carrying data, but voice as well.

Reliability

Voice networks are considered mission critical to a contact centre. Circuit-based voice networks are designed to be reliable and available for 'five nine's'. This means that the voice network is available 99.999% of the time.

When a contact centre migrates to Voice over IP, it is critical that these data networks give the same reliability and availability. It is absolutely critical that the IT administrators are involved in the deployment of Voice over IP, and that they understand the technical challenges and network requirements in order to support it. These issues are more difficult to address as a corporate LAN gets larger and voice traffic passes through more gateway/router points.

It is important for the IP products that are chosen to offer redundancy options. In addition if there is a problem with one of the systems, the end points need to be able to reconnect so that the call is not lost. To the extent that five nine's are required, a contact centre must evaluate their cost versus the monetary benefits of deploying an IP contact centre.

Getting Around the Challenges

Below are some ways to get around the challenges outlined above.

Bandwidth Planning

The key factor to minimizing these issues and ensuring high voice quality is to guarantee bandwidth in the network for voice, as well as enough bandwidth to handle the critical applications that require data across the network. This bandwidth analysis should happen in the early stages of a Voice over IP deployment.

Bandwidth analysis and capacity assessments must be done to not only determine network requirements, but to help you choose between different design options. Enterprises may need to upgrade their LAN/WAN to support voice traffic and to ensure a high quality of service. It is critical to factor in not only the Voice over IP traffic, but also the other traffic that is occurring concurrently. Lastly, there are technologies available that allow for voice to be prioritised over the data on the network. The same type of network bandwidth planning must occur with IP as with circuit-based network. The network requirements may not be as large as they are with circuit-based networks due to compression of the voice. However, it is critical that network planning occurs before implementation of Voice over IP within an enterprise or contact centre.

Echo Cancellation

When echo cancellation is on, latency is impacted. One option to avoid this is to enable echo cancellation on the side of the end customer and to turn echo cancellation off for the agents. This would dramatically reduce the latency that would occur with having echo cancellation on the both the agent and the customer side.

Silence Suppression

Silence suppression utilizes an algorithm in either the gateway or telephone equipment to eliminate transmission of packets when one of the parties is not speaking. Utilizing silence suppression allows for more efficient use of the network, which in turn can reduce congestion, jitter or latency.

With many vendors, silence suppression can be enabled on the agent side, the trunk side, on both sides, or silence suppression can be turned off. Enabling silence suppression can dramatically improve network efficiency, especially when calls are transported via WAN links.

Compression

There are compression algorithms that take the voice and compress it before it is placed in packets. Each compression standard uses a different block or “frame size” for the packets that are needed to transport the speech. The frame size has an impact on voice quality that will vary depending on the compression standard used. Some of the compression standards are below.

Codec	Voice Compression Rate	Typical Bandwidth (depends on the number of voice paths and codec).	Typical Packetization Delay	Minimum Packetization Delay
G.711	64Kbps	Avg 80 kbps/voice path	20 ms	1 ms
G.726	32Kbps	Avg 48 kbps/voice path	20 ms	1 ms
G.729a	8Kbps	16 kbps/voice path	40 ms	10 ms
G.723.1	6.3Kbps	12 kbps/voice path	60 ms	30 ms

The bit rate is the rate of transmission for the voice stream. Each of these protocols requires the overhead of the transmission layer, i.e. RTP, UDP, and IP. The size of the overhead is determined by the network protocols in use and is measured in bytes per packet. A typical network overhead for one VoIP packet required between 32 to 60 bytes.

The total bandwidth required for the media protocol is the sum of the voice stream data plus the overhead. For example, with G729.a, it would be 8kbps plus the added overhead size, multiplied by the frequency the packets are sent.

Two examples of G.729a are below.

- Payload multiple of 4 (80 bytes)...4 voice paths
 - Packets are sent every 80 milliseconds.
 - Each packet consists of 80 bytes of voice stream information and 40 bytes of overhead.
 - There are 120 bytes (960 bits) per packet.
 - There are 12.5 packets every seconds, hence 12000 bits per second or 12 kbps.
- Payload multiple of 1 (20 bytes)...1 voice path
 - Packets are sent every 20 milliseconds.
 - Each packet consists of 20 bytes of voice stream information and 40 bytes of overhead.
 - There are 50 packets every second resulting in 24kbps.

Voice over IP has built-in latency, which grows with the size of the payload. This latency is not just the packet delay but also includes accumulated processing time required for the decoding and restoration of the voice stream.

It is critical that network administrators understand the complexities of Voice over IP and latency when determining bandwidth requirements.

Evaluation

Lastly, contact centres must consider reliability and availability within the IP solutions that are being evaluated in terms of redundancy and fail-over options.

Summary

Voice over IP is a technology. You should evaluate the technology to the extent it leads to your corporate strategic and tactical goals. The technology has advanced significantly over the past few years and there are large business benefits with Voice over IP. To learn more about Voice over IP in the contact centre and available Voice over IP solutions, please contact MX Digital Limited.