

Skype™

A Solution to Business Conferencing



Application White Paper

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As a startup company WideBand Solutions is always looking for smarter ways to work. Time and human resources are extremely valuable as we build our organization. Daily collaboration is essential to our success, however with offices located in Reading, MA and Farmington, CT, it can be challenging. Conference calls are frequent with two or three sites participating regularly. In addition to the challenge of working in separate offices, two of the founders were born in Asia and speak English as a second or third language. While their English is very good, the transmission of crystal clear speech is a must for anyone conversing in a second language.

As a developer of DSP (Digital Signal Processing) products we embrace new technology, so we started using the voice conferencing feature of instant a messenger client. This was a free way to conference but reliability and quality were not consistent. A WideBand Distributor (*Wilf Langevin of Thorvin Electronics*) introduced us to Skype. Soon after the introduction to Skype, we began using for internal meetings, demonstrations and dealer training.

During my 11 years of selling teleconferencing equipment I have had the opportunity to talk with users in some of the World's largest corporations about their conferencing requirements. Audio conferencing continues to be the most popular solution to distant meetings. Even with significant innovations in the industry, two common complaints are often heard from these high volume teleconferencing users:

“I can't hear the distant end!”

“I can't understand all of the participants!”

These issues may be resolved by a solution that addresses the poor quality of telephone call and accommodates the acoustic challenges of a conference room. This paper discusses the role of each as a solution for business conferencing.

Who Is Skype?

Skype Technologies S.A. is a startup launched in August of 2003 by Niklas Zennström of Sweden and Janus Friis of Denmark. They were responsible for the peer-to-peer music-swapping site Kazaa and have assembled a team with many of the same programmers. Skype has turned voice calls over the Internet from a novelty with early Internet phones

to a real solution with quality and reliability worthy of business use. Users download the software for free and initiate calls from an “Instant Messenger” type user interface. Users cannot only talk for free but can also initiate multiparty calls to other Skype users.

Skype has also resolved issues with working behind firewall, NAT and routers. Over the past few months I have used Skype for demonstrations over networks at Fortune 500 firms, law firms and government agencies with a 100% success rate.

Skype uses “Disruptive Technology” to describe their product. After a year of operation they boast a base of 4.5 million users worldwide. As Skype gains popularity their service will most likely accelerate the shift to VoIP.

Features Provided by Skype

No toll calling anywhere in the world to other Skype users.

Multi-party bridging

Security

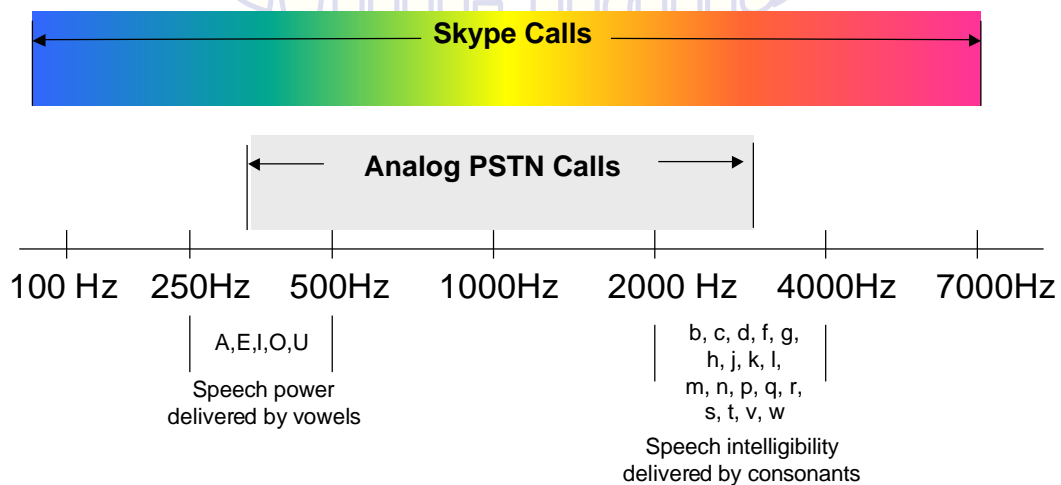
7kHz sound quality

How Skype is better than the Publicly Switch Telephone Network (PSTN)

Quality

For over one hundred years the quality of telephone calls has been relatively unchanged. To accommodate a high volume of calls over copper, the phone companies limit the call quality to 300Hz to 3400Hz. In comparison, AM radio achieves quality up to 5kHz.

Getting back to teleconferencing, a frequent complaint by users is “I can’t understand all the participants at the distant end”. Articulation is delivered in speech by consonants. The pass band of the PSTN cuts off frequencies necessary to delivery highly articulate speech.



Consonants like B, D, and P often run together over the phone and this requires a listener to resolve the unknown word from context. By providing a network that delivers up to 7kHz of audio, the physical speech is greatly improved. The quality improvement is particularly helpful to firms telecommuting across the globe in resolving barriers with accents and dialect.

Skype is achieving this quality by using an audio codec (code / decode) from Global IP Sound called iSAC. The codec is designed to transmit wideband audio at a low or high bit rate. iSAC is also designed for IP networks so the codec handles the latency and jitter associated with sending voice packets over the internet. The delay is much lower than videoconferencing and an improvement over past attempts of Internet phones.

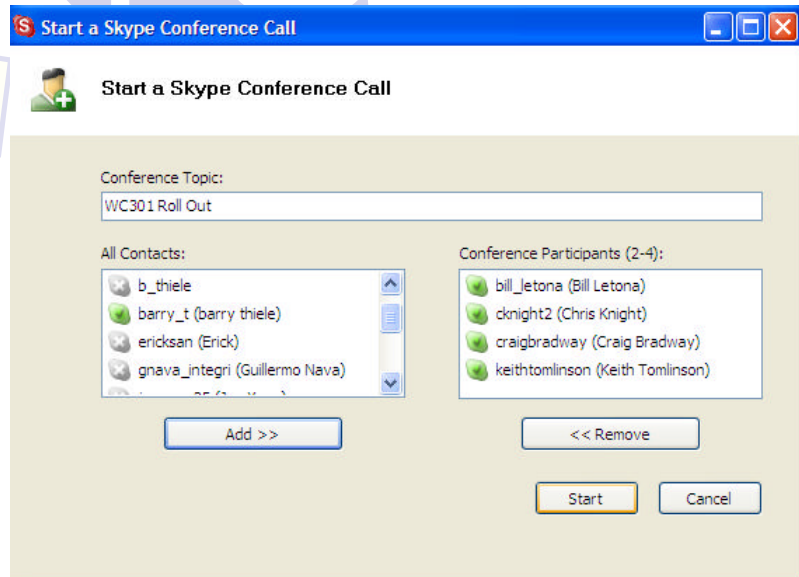
The codec uses 10–32kbps of bandwidth. At a 16kHz sampling rate the codec will achieve 7kHz sound quality. As the bandwidth drops so does the sound quality down to 3kHz at 10kbps.

Bridging

There are two ways to establish a call with multiple parties. The first is a feature available through the local Phone Company known as 3-way calling. This is popular with consumers who want to add a third party to the call. This type of call usually results in a loss of level between the 2 parties. The phone company typically charges monthly for this feature.

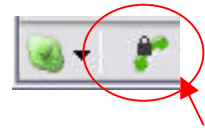
The second way is to use a bridge. This bridge could be a feature of a business telephone system or purchased through a service provider charging per port by the minute. Both 3-way calling and bridges are limited to 3kHz.

Skype offers bridging for five parties (4 + you) at no charge. Since the average business application is less than five sites, this is an extremely valuable feature. In addition to eliminating a toll the bridge call is wideband at 7kHz (when using 30kbps of bandwidth). This type of quality was previously only possible through more expensive video-conferencing equipment and bridges.



Security

Lack of security is often a concern when utilizing the Internet but IP telephony presents a more secure transmission than your home telephone. Skype adds security by encrypting each call. The following excerpt is from an article by Ken Belson of the International Harold Tribune:



encryption

Earlier this month, the Federal Communications Commission voted unanimously to move forward with rules that would compel the businesses to make it possible for law enforcement agencies to eavesdrop on Internet calls.

But developing systems to wiretap calls that travel over high-speed data networks - a task that the companies are being asked to pay for - has caused executives and some lawmakers to worry that helping the police may stifle innovation and force the budding industry to alter its services. That requirement, they say, could undermine some of the reasons Internet phones are starting to become popular: lower cost and more flexible features.

The commission's preliminary decision, announced on Aug. 4, is a major step in the long process of deciding how Internet-based conversations could be monitored. Regulators will now hear three months of public testimony on the ruling. Few expect a resolution of the issue this year, but it is not hard to figure out who will ultimately pay for the wiretapping capability.

"All the costs carriers incur are ultimately going to be passed on to the consumer," said Tom Kershaw, vice president for voice-over-Internet services at [VeriSign](#), which provides surveillance support for Internet phone companies.

Tapping Internet phones is far more complicated than listening in on traditional calls because the wiretapper has to isolate voice packets moving over the Internet from data and other information packets also traveling on the network.

While traditional calls are steady electronic voice signals sent over a dedicated wire, Internet calls move as data packets containing as little as a hundredth of a second of sound, or less than one syllable, which follow often-unpredictable paths before they are reassembled on the receiving end to form a conversation.

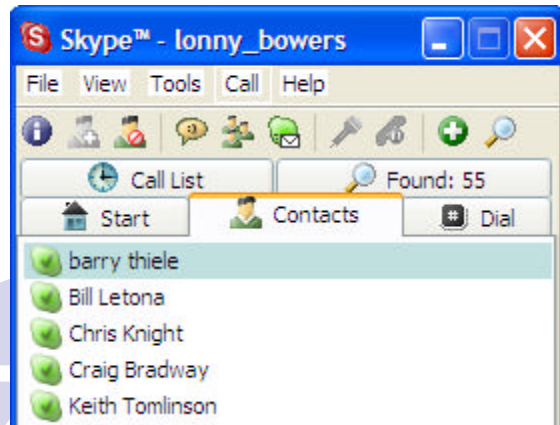
To make wiretapping possible, Internet phone companies would have to buy equipment and software as well as hire technicians, or contract with VeriSign or one of its competitors. The costs could run into the millions of dollars, depending on the size of the Internet phone company and the number of government requests.

The requirement to cooperate with law enforcement agencies is unlikely to drive any Internet phone company out of business, though it could cut into profits. Last year, the agencies conducted about 1,500 wiretaps, with the bulk of them in major cities like New York and Miami. The Federal Bureau of Investigation has yet to complete a wiretap over Internet phone services.

Features

Skype not only offers basic voice calls as well as popular features like instant messaging and availability status of a co-worker. A person's status may be set to available, away, not available or even invisible. The instant message feature may also be used during a call.

Skype also offers the ability to call over the PSTN (for a charge) termed Skype Out. Multi-party Skype Out calls are currently not an option. Before you Skype Out perform a test call with a co-worker or friend. In the 1.0.0.18 software release there is a considerable level difference between Skype calls and Skype Out calls.



The Right Hardware is Critical for Business Use

The telephone provides consistent performance due to the design of the handset. People are speaking only inches from the microphones and listening through an earpiece that is isolated from the microphone. Manufacturers of teleconferencing equipment for business have strived to design systems (costing \$500 to \$5000+) that sound as good as a telephone handset. A hands free system designed to be used by a group (speakerphone) creates challenges including the talker's distance to the microphone, noise, reverberation and transmission echo. If those issues weren't enough the quality is only 3kHz over the PSTN.

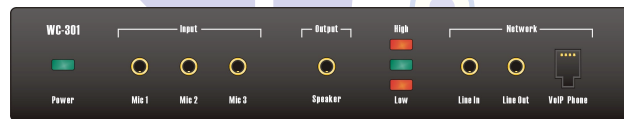
Skype promotes a telephone and headsets that may be used through the sound card of a computer. Group or hands free conferencing over Skype presents the same challenges inherent to speakerphones. The technology applied to high quality videoconferencing may also be applied to conferencing over Skype:

1. Acoustic Echo Cancellation (AEC) – A high performance echo canceller will prevent the microphone from transmitting the sound picked up by the loud speaker. Without AEC participants hear a delayed echo of their voice from the distant end that makes it virtually impossible to continue a thought. High

quality / robust AEC will also allow participants to talk over each other without clipping or loss of speech.

2. Noise Cancellation (NC) – A teleconferencing microphone is very sensitive so voices may be transmitted from several feet. The microphone will not only pick up the talker, but also noise from HVAC, projectors and laptops. NC removes this steady-state noise from speech and is a critical for intelligibility. Noise is a common nemesis with speaker / conference phones.
3. Automatic Gain Control (AGC) – Speech levels tend to vary from soft and timid to loud projecting voices. AGC lowers the level for loud voices and raises the level for softer voices. The algorithm works hand in hand with NC because as the level is increased so is the noise. Robust NC (15dB) and AGC maintain comfortable transmission levels from a group.
4. Auto Mixing – Most conference rooms require more than one microphone. An auto mixer should only activate the microphone that detects speech to reduce reverberation or the hollow sound associated with most speakerphones.

WideBand Solutions has developed the WC301 that provides AEC, NR, AGC and auto mixing for use with Skype and other web based teleconferencing applications. The unit does not require level adjustments or calibration.



WideBand Solutions – WC301 designed for group conferencing

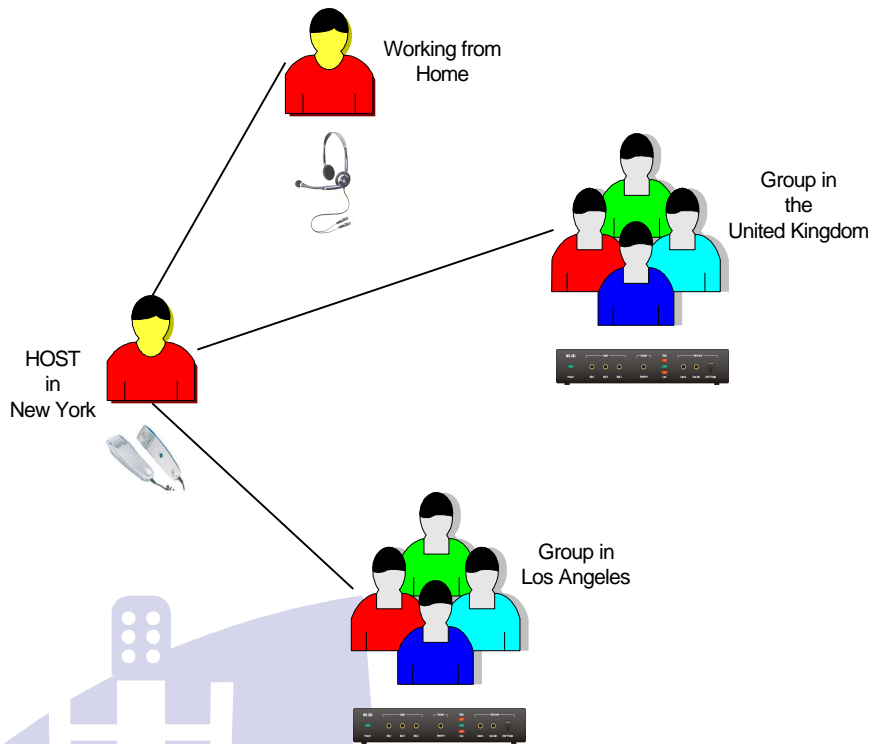


*Plantronics Headsets
available through
Skype*



*CyberPhone available
through Skype*

The diagram shows hardware deployed for a team business meeting over Skype. The host site is using a CyberPhone to provide the simplicity of a telephone. The telecommuter working from home is using a headset. The groups in LA and the UK are using a WC301 with the appropriate microphones and speakers to accommodate the groups.



Final Thoughts

Skype's dependence on a computer will slow adoption to many business users. Instant messaging is a good barometer to adoption since the user interface and some features are similar. According to Jupiter Media Metrix, Inc. 15.6 Million in the United States use instant messaging at work. The tool is used by many of us to collaborate with our colleagues on a regular basis.

The computer (though not perfect) has replaced the typewriter, address books and other tools used in the work place. Skype married with the appropriate hardware has the ability to improve the quality of conference calls without incurring a charge for the network or bridging. The improvement is dramatic when compared to conventional speaker and conference phones over PSTN. Adopters of the technology will never look back.

For information about products discussed in this paper please visit:

- Skype – www.skype.com
- WideBand Solutions – www.widebandsolutions.com
- Plantronics – www.plantronics-skype.com/prehome.asp
- VoIPVoice - <http://www.skype.voipvoice.com>