

# The Distributed Dawn

The emergence of versatile performance in the conferencing environment

Author:  
Jeff Rodman  
Fellow/CTO

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## Introduction

Systems that allow remote groups to interact in real time have dramatically grown in capability over the last thirty years. From the earliest instances of people huddled around the earpiece of a "candlestick" phone to today's fully-featured conference systems, the ability of people to cooperate over large distances has seen continual enhancement.

Along with the expanded capabilities of these systems, though, has been a growth in the number of physical elements that comprise them, and the difficulty of their operation. While the capabilities have increased, so has the subjective complexity, with the result that many fully-featured systems today are cluttered, difficult to understand, difficult to grow, and difficult to operate.

A new generation of systems has been introduced to alleviate this problem by coordinating the operation of its elements, and by allowing for the dynamic allocation of capabilities as meeting requirements change moment to moment. This results in a simpler and more unified control of the various functions in a meeting, more predictable and consistent behavior, less clutter on the tabletop, a more transparent presence overall, and a more versatile architecture that can support further growth.

## The VSX™ Distributed Conference System Architecture

From the user's perspective, one of the most important interfaces is the one where much of the conference occurs: on the tabletop. A new, versatile interface structure has been developed to provide versatility and high performance while maintaining a low physical profile. This is called ConferenceLink, and embodies both a physical and data format structure that are particularly well-suited to multimedia conferencing.

### VSX Infrastructure: The ConferenceLink Bus

ConferenceLink (Figure 1) is a robust and powerful digital communication bus that is optimized to support multiple media devices.

An increasing number of devices are compatible with the ConferenceLink format, including the VSX 7000 and VSX 8000 Videoconferencing systems, the SoundStation VTX 1000™ voice

conferencing system, the Virtual Concert graphics interface system, and the VSX microphone module. ConferenceLink's independence of the nature of the media it carries, and its optimization for reliable high bandwidth, bring many potentials to this growing ecology.

This high data bandwidth is especially valuable because it allows the exchange of more than just microphone outputs: intermediate data streams can be exchanged, which means significant processing resources can be distributed through the system, not just in a set-top or room

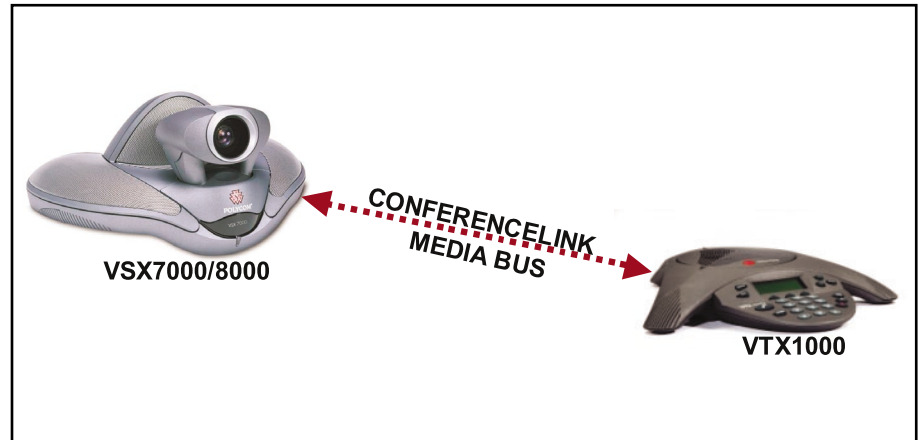


Figure 1: A Simple ConferenceLink Physical Connection

ConferenceLink contains independent clock and data channels (Figure 2). The total data rate is 36.768Mbps, divided into frames of 32kHz or 48kHz. These can be partitioned, for example, to provide 46 audio channels (16-bit audio at 48ksp/s for >20 kHz bandwidth) in an audio-only system, 32 two-megabit H.263 or H.264 video channels, 36 Mbps of raw high-availability data bandwidth, or any other desired allocation. Peripherals can both send and receive data, and

processing module. This is, in effect, a mesh computing network: an immensely flexible system architecture because processing can be scaled to match customer requirements, and a basic system does not need to be expensively over-designed to protect against possible future needs. Additional functions and additional processing can be added, when and where needed, as requirements develop.

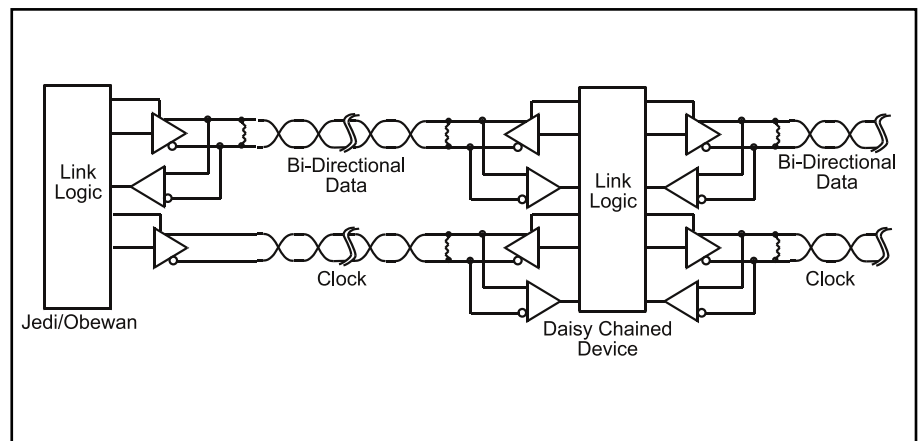


Figure 2: ConferenceLink Physical Connection

the data format, which is pre-scheduled, assures no collisions or lost packets and extremely low latency. As seen, ConferenceLink can also support daisy-chaining, which minimizes cabling while maximizing coverage.

### SoundStation VTX 1000 in a ConferenceLink-enabled System

The SoundStation VTX 1000, introduced last year, has spawned a revolution in high-performance voice conferencing. Beyond its precedent-setting ability to carry high-fidelity 7kHz voice over conventional POTS telephone lines worldwide, it also provides an extraordinary 20-foot voice pickup range without additional microphones, versatile audio interface capabilities, noise reduction, software upgrades for feature and performance upgrades in the field, and numerous other features. But this all stems from a ground-up design that supports configurability, flexibility, and distributed processing. The

than as a dedicated function. This allows much more versatility in adding new functions, interfaces, applications, and in implementing distributed processing.

The SoundStation VTX 1000 also contains a full ConferenceLink interface, and in its software versions 1.4 and later, is compatible with the VSX 7000 or VSX 8000 video conferencing system version 7.0 or later via this ConferenceLink connection.

### Capabilities in Integrated Mode

When a SoundStation VTX 1000 is connected to the VSX 7000 or VSX 8000 via ConferenceLink, it expands the capability of the VSX 7000

mode, audio bandwidth is 3kHz (during normal narrowband analog calls) or 7kHz (in VTX wideband analog connections over POTS). However, the SoundStation VTX 1000 operates as a 14kHz peripheral when connected to the VSX7000 via ConferenceLink (Figure 4).

All of the acoustic resources of the SoundStation VTX 1000 are available to the VSX 7000 at full bandwidth: the three internal microphones, the internal loudspeaker, the EX microphones, the Auxiliary input, the Auxiliary output, and the telephone interface, both narrowband and wideband. Note from this figure that while the SoundStation VTX 1000 may be supporting a narrowband POTS call, it can simultaneously support 14kHz audio to the VSX 7000. In a mixed call like this, then, it will seem to everyone as if they all have a great 14kHz wideband connection, except that one person's phone (the one on the conventional POTS call) will sound muffled.

**SoundStation VTX 1000 User Interface Resources**  
Because the SoundStation VTX 1000 naturally resides on a conference table and contains a graphic backlit LCD, keypad, and several LEDs, it can provide convenient access to some of the most common user interface functions. These elements are all available to the VSX 7000 via the ConferenceLink, either as button presses and bitmapped pixel images, or as interpreted data.

### SoundStation VTX 1000 Processing Engine Resources

The SoundStation VTX 1000 processor contains an additional 1000 million instructions per second (MIPS) of processing power that is available to the VSX 7000 when needed, and the ConferenceLink bus provides high-availability, high-speed access that is the data bus equivalent of an eight-lane superhighway. While the 36Mbps data rate seems one-third that of a 100BaseT connection, the achieved bandwidth is several times what can be reliably achieved over most 100BaseT networks because ConferenceLink is a fully time-scheduled protocol: Packet collisions, backoff, and resends never occur, so the data bandwidth is almost entirely available for payload.

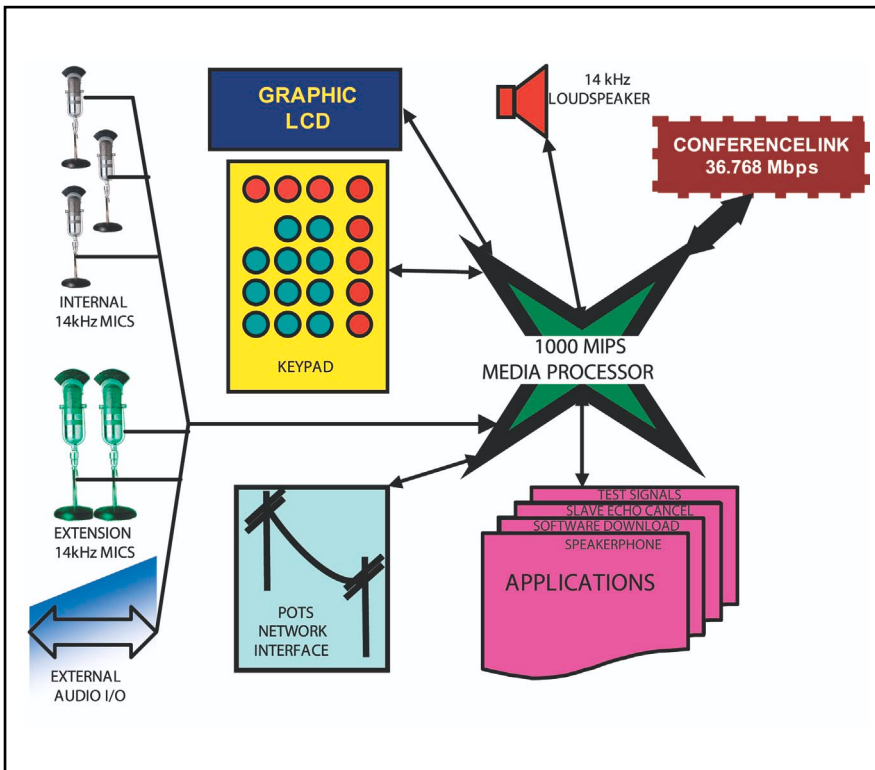


Figure 3: SoundStation VTX 1000 Resources accessible via ConferenceLink

SoundStation VTX 1000 (Figure 3) serves a full set of audio input and output functions with an extremely powerful signal processor, which can provide up to 1 billion operations per second. By way of comparison, this is more than 50% more powerful than the processor used in Polycom's earlier ViewStation® 128 videoconferencing system. The VTX1000 is architected to treat the speakerphone function as a modularized application that is executed by this processor, rather

because the video system is now presented with additional sets of resources: acoustic resources, common user interface resources, and processing engine resources.

### SoundStation VTX 1000 Acoustic Resources

The SoundStation VTX 1000 operates at an internal sampling rate of 32kHz, which is high enough to support audio performance up to 14kHz. In SoundStation VTX 1000 standalone

Interestingly, the fact that the SoundStation VTX 1000's media processor is co-located with the microphones does not mandate that it be used for microphone processing; if the system architect desired, it could equally well be used for some video processing task, as long as it fit within the overall constraints of the system. It is this kind of flexibility that makes the ConferenceLink and VTX-VSX architecture particularly powerful and versatile.

### The Potential of Distributed Integration

With all of these capabilities, the question moves from "can we do it" to "what shall we do?" Expanding the availability of high-performance resources such as microphones, processing, displays, and controls offers the potential of simpler, better, and more compact conferencing configurations. Some possible advantages include the elimination of multiple microphones for multiple independent systems in the same environment, the harmonization of user interfaces and system control, implementation of a common dialing structure, a lower rate of obsolescence due to more flexible expandability, and leveraging the addition of new features into all system uses, not just one. The Polycom white paper "The Power of Shared Resources" discusses a pioneering implementation of such a system, using the VSX 7000 and SoundStation VTX 1000 products as available today. Polycom believes that this is the tip of the iceberg, and that the user benefits of this radical architectural approach will continue to make very substantial improvements in the way systems, and users, operate.

### The Polycom Office™

With integrated video, audio, data, and Web capabilities, The Polycom Office is the only solution that offers an easy way to connect, conference, and collaborate any way you want. Work faster, smarter, and better with The Polycom Office.

Polycom, Inc. develops, manufactures and markets a full range of high-quality, easy-to-use and affordable voice and video communication endpoints, video management software, web collaboration software, multi-network gateways, and multi-point conferencing and network access solutions. Its fully integrated end-to-end solution, The Polycom Office, is supported by the Polycom accelerated communications architecture and enables business users to immediately realize the benefits of integrated video, voice data and web collaboration over rapidly growing converged networks.

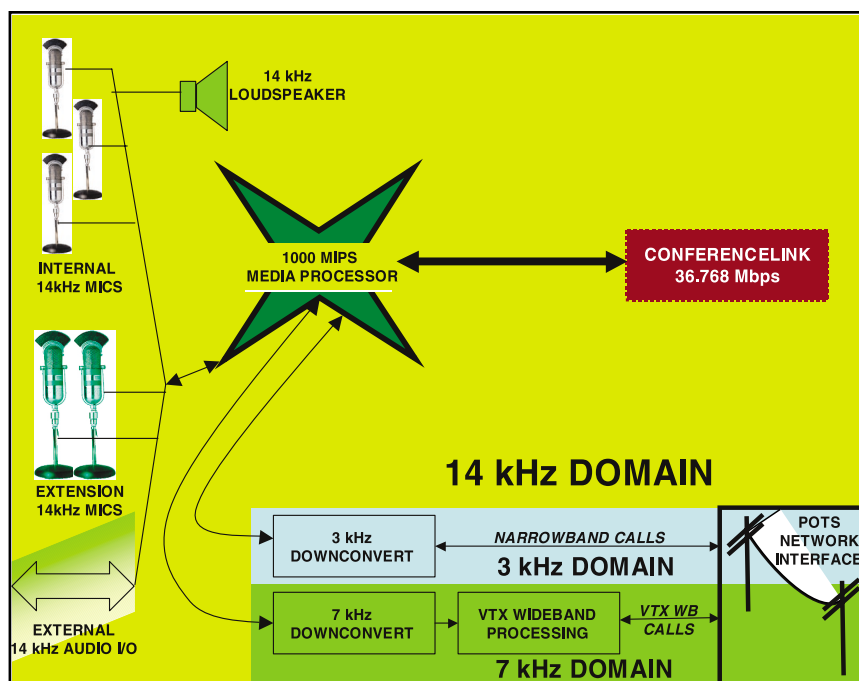


Figure 4: SoundStation VTX 1000 Internal Bandwidth Domains

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**Polycom Headquarters:**

4750 Willow Road, Pleasanton, CA 94588 (T) 1.800.POLYCOM (765.9266) for North America only.  
For North America, Latin America and Caribbean (T) +1.925.924.6000, (F) +1.925.924.6100

**Polycom EMEA:**

270 Bath Road, Slough, Berkshire SL1 4DX, (T) +44 (0)1753 723000, (F) +44 (0)1753 723010

**Polycom Asia Pacific:**

Polycom Hong Kong Ltd., Rm 1101 MassMutual Tower, 38 Gloucester Road, Wanchai, Hong Kong, (T) +852.2861.3113, (F)+852.2866.8028

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