CONFERENCE V 5.0

OVERVIEW

The Adaptive Digital Technologies Conferencing software is designed to provide conference call capability to telephone systems as well as to voice and video conference servers. Our conferencing algorithm adds the active conference input signals together to form a composite signal. Before sending the composite signal back to each conference party, that party's transmission is removed from the composite signal to avoid the perception of echo. The conference algorithm is available in a narrowband version, which operates at the typical telephony-sampling rate of 8 kHz, as well as a wideband version, which operates at an audio sampling rate of 16 kHz. The wideband version is suitable to be used in high-end conferencing equipment as well as in VoIP applications in which wideband audio is supported. Also available is the mixed rate version. That is able to bridge together both narrowband and wideband conference parties into a single conference.

FEATURES

- Narrowband, Wideband, and Mixed Narrowband/Wideband capable
- Number of conference participants is user configurable
- Participants can be added and deleted from conference at any time
- Automatic Level Control
- Overflow Protection
- Voice Activity Detection
- Noise Suppression
- Dominant Speaker Selection
- Multi-conference capable
- Functions are "C" callable

- Preemptive Member Assignment

  When a conference member is assigned preemptive status, all other members' signals will be suppressed and the preemptive member's signal will be the only signal included the conference sum.

- Priority Member Assignment

  Normally, conference is configured with a number of dominant speakers, typically three. This means that regardless of how many conference members are present, only the three loudest members will be summed at any given time. By assigning priority status to a conference member, that member's signal will always be added to the sum.

- Variable Frame Size

  Build that can support different frame sizes among conference members

AVAILABILITY

ADT Conferencing is available on the following Platforms: Other configurations are available upon request.

Product	wbnb	wb	nb	Device	Platform	Memory Model	Endian	Code Gen Tool Version
ADT_conf	✓	✓	✓	_ c64x+ / c66x	TI TMS320C64x+ / C66x	L3	Little	N/R
ADT_conf	✓	✓	✓	_ c64x	TI TMS320C64x	L3	Little	N/R
ADT_ conf	✓	✓	✓	_ c55x	TI TMS320C55x	Large	Little	N/R
ADT_ conf	✓	✓	✓	_ c54x	TI TMS320C54x	Far	N/A	N/R
ADT_conf	✓	✓	✓	_armA8	ARM Cortex-A8	N/A	Little	Code Sourcery Linux 2011_09-70
ADT_ conf	✓	✓	✓	_armA9	ARM Cortex-A9	N/A	Little	Code Sourcery Linux 2011_09-70
ADT_ conf	✓	✓	✓	_armA15	ARM Cortex-A15	N/A	Little	Code Sourcery Linux 2011_09-70
ADT_conflib	✓	✓	✓	_arm9e	ARM9e	N/A	Littlr	Code Sourcery Linux 2011_09-70
ADT_confdll	✓	✓	✓	_win32	Win32	N/A	Little	VS2010
ADT_conflib	✓	✓	✓	_win32	Win32	N/A	Little	VS2010
ADT_conflib	✓	✓	✓	_i686	Linux i686	N/A	Little	gcc

Endian, byte order: “Little Endian” means that the low-order byte of the number is stored in memory at the lowest address, and the high-order byte at the highest address. "Big Endian" means that the high-order byte of the number is stored in memory at the lowest address, and the low-order byte at the highest address.

Acronyms

Mm – Memory Model: Memory Model is specific to Texas Instruments processors.

N/A – Not Applicable

N/R – Not Recorded

mbnb – Mixed Wideband and Narrowband

wb – Wideband

nb – Narrowband

PRODUCT DESCRIPTION

Narrowband, Wideband, and Mixed Narrowband/Wideband capable

You might ask, what’s the big deal? Why can’t I simply add the signals together?

Adding the signals together works well enough if the number of conference participants is very small and there is no need to support mixed narrowband and wideband simultaneously. Of course, you do need to subtract each party’s own speech from the conference composite (sum) as mentioned above to avoid the perception of echo.

As the number of conference participants increases, we run into a few more issues to deal with. For example, each participant presumably has some level of background noise. The noise level may be low as is the case in an office environment (without any fans running.) The noise level can also be quite high – as is the case for a person on a cell phone while driving. And it can be anywhere in between. If we were to add all the input signals blindly, the noise would accumulate more and more as the number of conference participants increased. Furthermore, when using fixed point

arithmetic, the summation of many signals – some of which include speech signals – can cause overflow or clipping, a very undesirable condition.

Our algorithm uses a variety of techniques to combat these issues. For example, only a few "dominant" speakers' signals are added to the conference at any given time. This reduces the number of signals being added. Furthermore, noise suppression is employed on all input channels. So even when there is significant background noise that would otherwise bleed into the conference sum, the noise suppressor reduces the extent of such noise. Automatic Level Control is employed to combat overflow and clipping as well as to compensate for different amounts of network loss that is seen in party's input signal. We have integrated all these algorithms and optimized them to work together to achieve optimum voice quality in high-density conference situations.

Finally, Adaptive Digital's conference algorithm includes support for mixing narrowband (8 kHz sampled) and wideband (16 kHz sampled) participants into the same conference. While this is not brain-surgery in and of itself, combining this feature with the other features in a way that preserves voice quality is quite important.

Not to be overlooked is the fact that we have combined all this functionality using a minimum of processor resources (MIPS and Memory). After all, if you need high-density conferencing, you probably want to do so with a minimum number of processors and as little memory as possible.

All that said, in addition to the more sophisticated, voice quality enhancing features, we added a simple but useful feature. Sometimes it is desirable to allow one (or more) participants to take precedence to others in the conference summation regardless of voice activity. We call these participants "priority" participants. The user can set conference participants to be priority participants and set them back to "normal participants" at any time during an active conference.

SPECIFICATIONS

TI TMS320

C64x & C64x+

CPU UTILIZATION & MEMORY REQUIREMENTS

All Memory usage is given in units of bytes.

Software	Peak Loading (MIPS)	Program Memory	Data Memory	Per Channel Data Memory	Scratch Memory
Narrowband	0.35 + N*0.25	9280	1154	60 + 116*NC + 32*NCP	8*FS + 12*MAX_DOMN
Wideband	0.70 + N*0.50	9280	1154	60 + 116*NC + 32*NCP	8*FS + 12*MAX_DOMN
Mixed	0.9 + N*1.2	1120	128	256*NCP	FS*2 + 128

N = Number of participants in conference
Note: MIPS estimate is for a processing frame size of 80 for narrowband, 160 for wideband.
NC = Number of conferences
MAX_DOMN = maximum dominant N setting
FS = Frame Size

Specification tables Cont'd -

TI TMS320

C55x

CPU UTILIZATION & MEMORY REQUIREMENTS

All Memory usage is given in units of bytes.

Software	Peak Loading (MIPS)	Program Memory	Scratch Memory	Persistent Memory
Narrowband	0.6 + N*0.30	3602	8*FS + 12*DN + 874	52*N + 88
Wideband	1.2 + N*0.6	3602	8*FS + 12*DN + 874	52*N + 88
Mixed	1.0 + N*1.6	4100	10*FS + 70*DN + 1002	52*N + 344

N = Number of channels in conference
FS = Frame Size

C54x

CPU UTILIZATION & MEMORY REQUIREMENTS

All Memory usage is given in units of 16-bit words.

Software	Peak Loading (MIPS)	Program Memory	Scratch Memory	Persistent Memory
Narrowband	0.38+ N*0.35	1783	371+4*FS+6*DN	38 + N*26
Wideband	0.76+N*0.70	1783	371+4*FS+6*DN	38 + N*26
Mixed	0.50+N*1.77	2100	435+5*FS+70*DN	166 + N*26

N = Number of participants in conference
FS = Frame Size
DN: Number of Dominant Channels

ARM

ARM Cortex A8/A9/A15

CPU UTILIZATION & MEMORY REQUIREMENTS

All Memory usage is given in units of bytes.

Function	Conf Type	#8k Members	#16k Members	MIPS	Program Memory	Per Conference Data Memory	Per Member Data Memory	Scratch Memory
CONF_ADT_run	Mixed 8k Variable FS	8	0	6.6	17.3k	128	356	4004
	Mixed 8k Variable FS	4	4	33.3				
	Mixed 8k Variable FS	0	8	57.9				
	Mixed 16k Variable FS	8	0	56.5				
	Mixed 16k Variable FS	4	4	32.6				
	Mixed 16k Variable FS	0	8	10.9				

ARM9e

CPU UTILIZATION & MEMORY REQUIREMENTS

All Memory usage is given in units of bytes.

Function	Conf Type	#8k Members	#16k Members	MIPS	Program Memory	Per Conference Data Memory	Per Member Data Memory	Scratch Memory
CONF_ADT_run	Mixed 8k Variable FS	8	0	6.9	18.1k	128	356	4004
	Mixed 8k Variable FS	4	4	34.7				
	Mixed 8k Variable FS	0	8	59.8				
	Mixed 16k Variable FS	8	0	57.4				
	Mixed 16k Variable FS	4	4	33.9				
	Mixed 16k Variable FS	0	8	13.4				

LINUX

I686

CPU UTILIZATION & MEMORY REQUIREMENTS

All Memory usage is given in units of bytes.

Function	Conf Type	#8k Members	#16k Members	MIPS	Program Memory	Per Conference Data Memory	Per Member Data Memory	Scratch Memory
CONF_ADT_run	Mixed 8k Variable FS	8	0	6.2	13.3k	128	356	4004
	Mixed 8k Variable FS	4	4	51.4				
	Mixed 8k Variable FS	0	8	90				
	Mixed 16k Variable FS	8	0	88.1				
	Mixed 16k Variable FS	4	4	51.5				
	Mixed 16k Variable FS	0	8	9.4				

Windows/x86 DLL

Win DLL

CPU UTILIZATION & MEMORY REQUIREMENTS

All Memory usage is given in units of bytes.

Function	Conf Type	#8k Members	#16k Members	MIPS	Per Conference Data Memory	Per Member Data Memory	Scratch Memory
CONF_ADT_run	Mixed 8k Variable FS	8	0	6.96	128	356	4004
	Mixed 8k Variable FS	4	4	28.82			
	Mixed 8k Variable FS	0	8	46.46			
	Mixed 16k Variable FS	8	0	43.73			
	Mixed 16k Variable FS	4	4	25.59			
	Mixed 16k Variable FS	0	8	11.43			

Win Static Lib

CPU UTILIZATION & MEMORY REQUIREMENTS

All Memory usage is given in units of bytes.

Function	Conf Type	#8k Members	#16k Members	MIPS	Program Memory	Per Conference Data Memory	Per Member Data Memory	Scratch Memory
CONF_ADT_run	Mixed 8k Variable FS	8	0	5.47	10.4k	128	356	4004
	Mixed 8k Variable FS	4	4	29.82				
	Mixed 8k Variable FS	0	8	51.18				
	Mixed 16k Variable FS	8	0	43.73				
	Mixed 16k Variable FS	4	4	25.84				
	Mixed 16k Variable FS	0	8	9.44				

MIPS characterized using a 8-channel conference.
Mixed 8K/16K conference characterized with half of the members at 8 kHz and half of the members at 16 kHz members

We specify MIPS (Millions of Instructions Per Second) as MCPS (Millions of Instruction Cycles Per Second). Unless otherwise specified, peak MIPS are indicated.

FUNCTIONS

CONF_ADT_init	Initialize a conference
CONF_ADT_addMember	Add a member to a conference
CONF_ADT_removeMember	Remove a member from a conference
CONF_ADT_run	Perform conference mixing
CONF_ADT_getStatus	Get key conference statistics
CONF_ADT_setPriority	Set a conference member as a priority member
CONF_ADT_clearPriority	Clear a conference member’s priority status
CONF_ADT_setPreemptive	Set a conference member to be preemptive
CONF_ADT_clearPreemptive	Clear a conference member’s preemptive status

Deliverables

The deliverable items are platform dependent. In general, there is one library. (Sometimes multiple variants of the library are included in the deliverables.) There are also header files, some of which are specific to the product and others are common across many of Adaptive Digital's products. Also included in the deliverables is product documentation, which includes a users guide and usually includes release notes and a data sheet. Sample/test code may be included as well.

Adaptive Digital is a member of the Texas Instruments Developer Network, and ARM Connected Community.

CONTACT INFORMATION

Web: www.adaptivedigital.com
Email: information@adaptivedigital.com
Tel: 610.825.0182 ~ Toll Free: 1.800.340.2066
Fax: 610.825.7616
Address: 525 Plymouth Road, Suite 316
Plymouth Meeting, PA 19462