

VoIP – Closing the Voice Quality Gap

提高 VoIP 的话音质量

Brian McCarthy

President 公司总裁

Adaptive Digital Technologies, Inc.

610-825-0182

information@adaptivedigital.com

<http://www.adaptivedigital.com>

<http://wizard.adaptivedigital.com>



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Adaptive Digital Technologies, Inc

公司简介

- Established in 1994 创立于一九九四年
- Specializing in DSP algorithms for Telecom and Voice Quality Enhancement
致力于通讯领域的数字信号处理算法和语音质量增强技术的研发
- Offices in suburban Philadelphia and San Jose 公司所在地：费城和硅谷
- Distributor of Video

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VoIP—Closing the Voice Quality Gap

提高 VoIP 的话音质量

- VoIP vs. Legacy Telephone Network
VoIP网络和传统电话网络
- VoIP Impairments 缺陷
- Overcoming VoIP Impairments 克服缺陷
- Taking VoIP Beyond Legacy Performance
超越传统网络的性能
- How Integrated DSP Software Can Help
集成的DSP软件方案
- Demonstrations 演示

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VoIP vs. Legacy Telephone Network

| Feature | Legacy 传统 | VoIP IP 网络 |
|-------------------------------------|------------|--------------------|
| Switching 交换 | Circuit 电路 | Packet 包 |
| Network Reliability 网络可靠性 | High 高 | Varies 不确定 |
| Delay 延迟 | Low 低 | Varies 不确定 |
| Vocoder 压缩编码 | G.711 PCM | Selectable 可选多种 |

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VoIP Impairments

VoIP 的缺陷

- Delay, Delay Jitter, Out of Sequence Packets
延迟，包次序混乱
- Packet Loss 包丢失
- Echo 回声
- Vocoder 压缩编码

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Step 1: Overcoming VoIP Impairments

克服VoIP的缺陷

- Delay -> Jitter Buffer
延迟 -> 存储缓冲
- Out of Sequence Packets -> RTP, Jitter Buffer
包到达次序混乱 -> 实时传输协议, 缓冲
- Packet Loss -> Packet Loss Concealment
包丢失 -> 包恢复技术
- Echo -> Echo Cancellation
回声 -> 回声抵消
- Vocoder -> Use G.711 or better?
压缩编码 -> 使用G.711 或更好压缩算法?

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Step 2: Taking VoIP Beyond Legacy Performance 超越传统网络的性能

- Wideband Audio
宽带信号
- Algorithm Optimization
信号处理算法的优化

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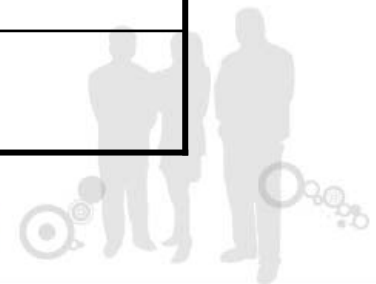


Wideband Audio

宽带声音信号

| Algorithm | Audio BW (kHz) | Bit Rate (kbps) | MOS |
|-----------|----------------|-----------------|------|
| G.711 | 3.4 | 64 | 4.0 |
| G.722 | 7 | 64 | 4.2 |
| G.722 | 7 | 48 | 4.14 |
| G.722.1 | 7 | 32 | 4.0 |
| G.722.1 | 7 | 16 | 3.7 |

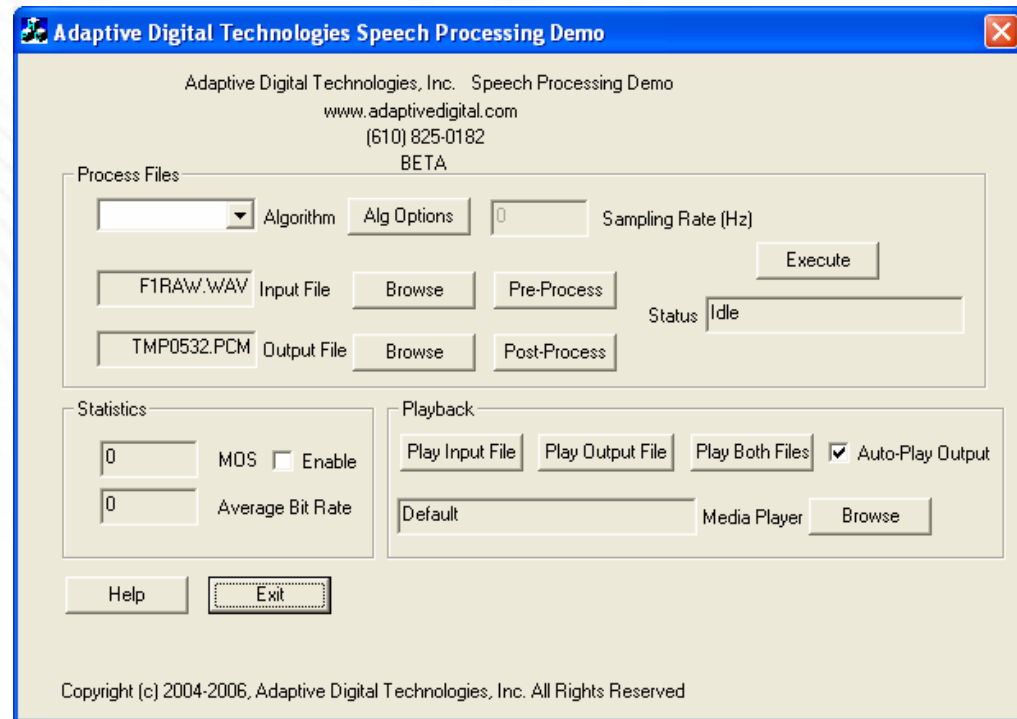
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Voice Processing Demo

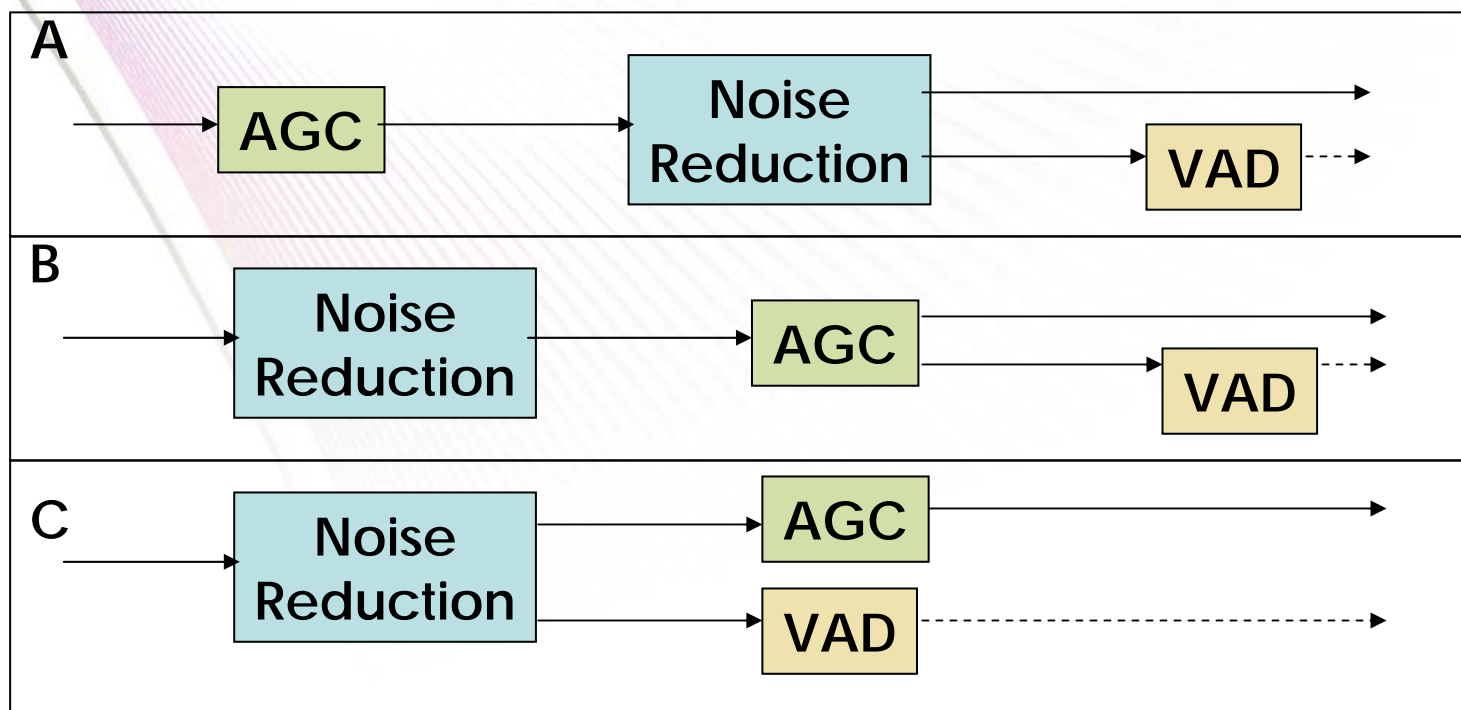
语音信号处理演示

- PC Based
PC 演示软件
- Free to use
免费使用



Algorithm Optimization

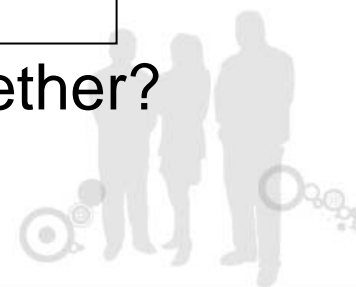
信号处理算法的优化



What happens when adaptive algorithms run together?

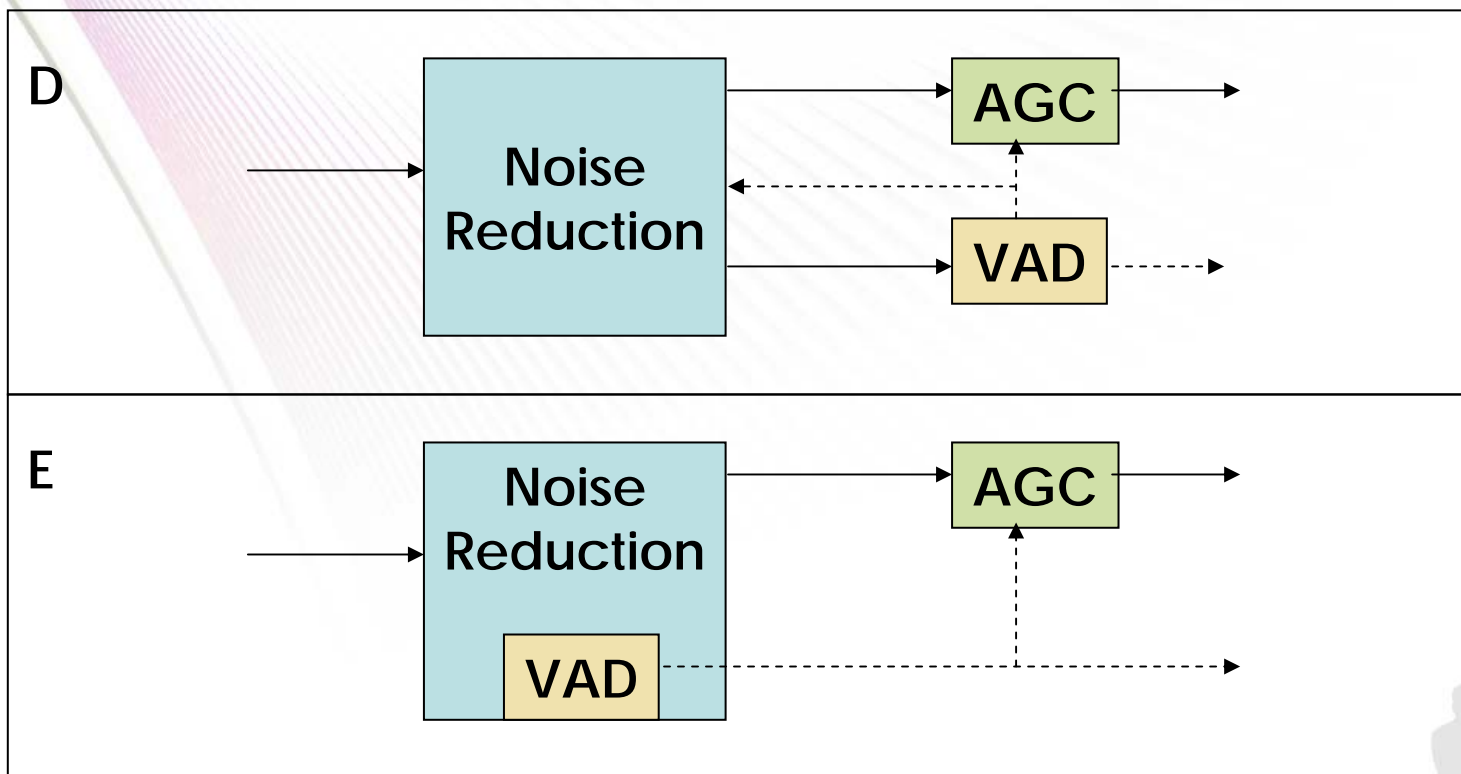
Which option is best – A, B, or C?

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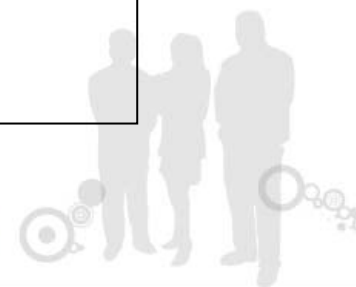
Algorithm Optimization

信号处理算法的优化



How about option D or E?

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Conference Application

应用举例：电话会议系统

Integrates Many Dynamic Algorithms 算法集成

- Echo Cancellation (**AT&T Certification!!**) 回声抵消
- Noise Reduction 噪声抵消
- Noise Suppression 噪声抑制
- Voice Activity Detection (VAD) 话音检测
- Automatic Gain Control (AGC) 自动增益控制
- Dominant Speaker Selection 强拣选

Proper integration and inter-working is fundamental to attaining optimum voice quality

正确集成与整合是获得最佳话音质量的基础

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Algorithm Optimization

算法模块的优化

Q: When do we get the best voice quality?

什么时候得到最好的语音质量?

A: When algorithms work together by:

- a. Sharing internal data
共享内部数据
AND / OR 和/或
- b. Calling each other as necessary
必要的互相调用

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Nuts and Bolts – Applying the Ideas

算法模块的链接 – 如何化为现实

- How do we ensure proper algorithm interaction?
如何确保算法模块间的正确互联？
 - Offer algorithms that are already integrated together. What's the limitation?
固化好的模块组合。局限？
 - Offer algorithms that are designed to work together. (Options D and E from earlier slide)
提供容易互联的算法模块
 - Application Specific Signal Processor (DSP + Software Image)
面向应用信号处理器：DSP+软件

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Application Specific Signal Processor (ASSP)

面向应用的信号处理器 (ASSP)

- ASSP=DSP+Downloadable Software Image
ASSP = DSP + 可载入软件
- Application is designed with algorithms properly integrated and working together
软件使用集成模块
- No DSP programming required
无需DSP编程
- API for host GPP provided to simplify interface
简单易用的控制器编程接口

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Algorithms vs. ASSP

处理模块与面向应用的解决方案

Customer SW

ADT SW

Control Processor
With
API to access DSP

DSP

Control

Scheduling

Multi-Channel
Input

Buffering

Algorithm A

Algorithm B

Buffering

Multi-Channel
Output

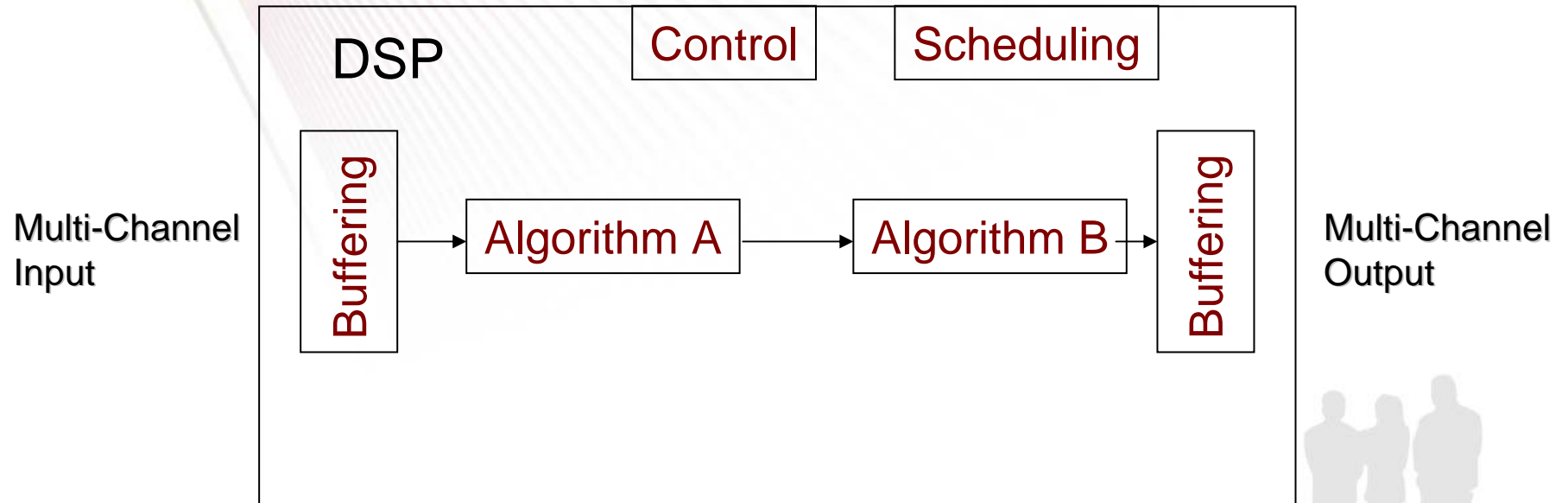
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ASSP vs. Algorithms

Customer SW
ADT SW

Control Processor
With
API to access DSP



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ASSP Examples

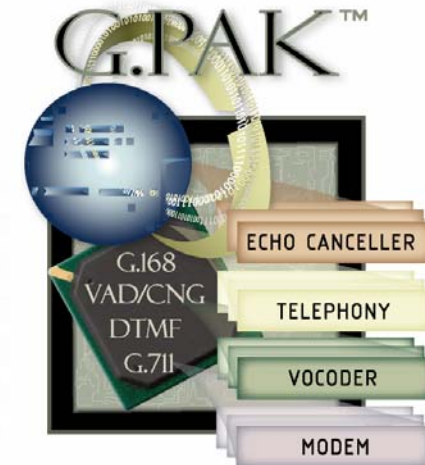
ASSP 软件实例

- iPhoneChip – (reference kit available)
- 512 Channel Conferencing Chip – C6416
- G.PAK VoIP
- 128 Channel Echo Canceller (C6424)
- 32 Channel Echo Canceller (C5510)
- 8 Channel Echo Canceller (C5507)
- IP PBX (C5510)
- Hands-Free VoIP Intercom (C5507)

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G.PAK™



- Rapidly builds ASSP software
快速生成ASSP软件
- Configured at build time with customer options
生成软件时可配置用户选项
- ANSI 'C' Software API for Host processor
提供控制器端C 语言程序接口

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DSP Resource Wizard™

Adaptive Digital Technologies, Inc. DSP Resource Wizard™

Tools | Quote Center | Download Center | Get Support | My Account | Log out | Store.AdaptiveDigital

Hello Tina

ADT Mode

C64x TMS320™ Generation

C6416 TMS320™ Device

600 Speed

Use G.PAK Framework

| | | MIPS (MHz) | Prog | Data | External | Total | |
|-------------|-------|------------|-------|------|----------|--------|--------------|
| Device | 600 | 1024 | 1024 | 0 | 1024 | 89.75 | \$/Chip |
| Application | 13.19 | 211.5 | 22.08 | | 233.59 | 1100.0 | mw/Channel |
| | | | | | | 533 | Area/Channel |

89.75 \$/Chip

1 Num Chan/Chip

49 Max Chan/Chip

89.75 \$/Channel

1100.0 mw/Channel

533 Area/Channel

Device Details | **Telephony** | Vocoders | Echo Cancel | Reset Selections

Modems | Video | Audio | Framework

Telephony by Adaptive Digital

Tone Processing

Gen/Det Relay Low Mem

DTMF Det Call Prog Det

MF R1 Det Tone Supp.

MF R2 Det Tone Gen

Arbitrary Tone Detect

Conferencing

3 Max Conf Members

1 Conf Per Core

VAD AGC

CNG Noise Reduction Beamforming

Noise Reduction (LC)

Caller ID

Tx

Rx (Type 1)

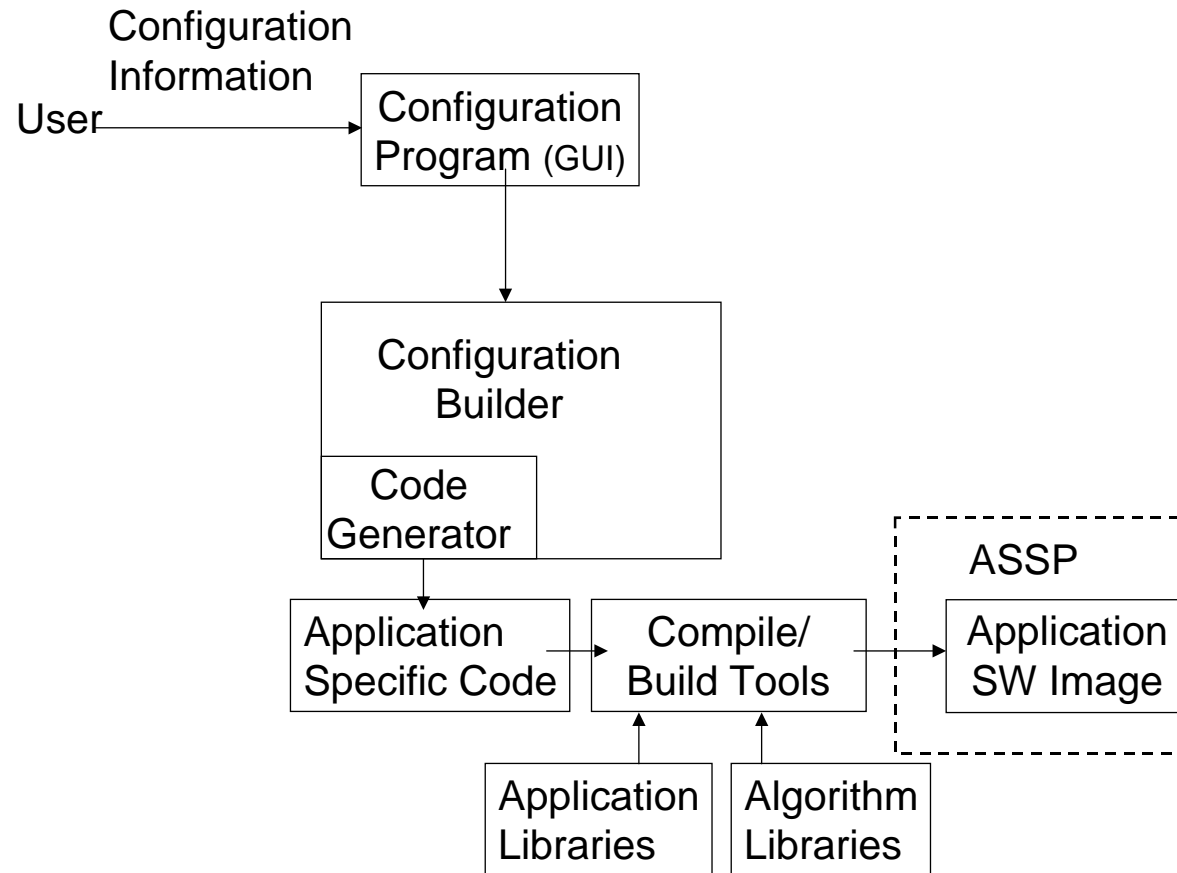
Rx (Type 2)

Applet adtwizard.Wizard started

extranet.adaptivedigital.com

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G.PAK Configuration



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G.PAK Configuration Builder

ADT G.PAK Configuration: W:\scott\products\Gpak64x\Gpak64xDsp\Gpak6416Develop.pjt

DSP Type
 5410 5416
 5420 5421
 5441 64xx

Channel Types
 Num Channels:
 TDM to Packet
 TDM to TDM
 Packet to Packet
 Circuit Data
 Conference TDM
 Conference Pkt
 Conference Comp

Vocoders
 G.723
 G.726 Low Mem
 G.726 Low MIPS
 16 kbps
 24 kbps
 32 kbps
 40 kbps
 G.728
 G.729AB
 ADT - 4800
 GSM EFR

Conferencing
 Instances:
 Spkrs/Instance:
 Dominant Spkrs:
 Noise Supr (dB):

Echo Cancellers
 Short Tail
 PCM
 Instance Count

Serial Port 1
 Slots/Frame:
 Max Active:

Serial Port 2
 Slots/Frame:
 Max Active:

Serial Port 3
 Slots/Frame:
 Max Active:

Packet Profile
 AAL2
 RTP (RFC 3550)
 Tone Relay
 Tone
 Event
 None
 Generate

Tone Detect Types
 Instances:
 Max Concurrent:
 DTMF
 MFR1
 MFR2 Forward
 MFR2 Reverse
 Call Progress
 CED
 CNG
 B side enable

Noise Suppression
 Include
 Max Atten (dB):
 VAD
 Lo (dBm):
 Hi (dBm):
 Hang (ms):
 Window (ms):

AGC
 Instances:
 Target Power (dBm):
 Loss Limit (dB):
 Gain Limit (dB):
 Low Signal (dBm):

Acoustic
 Instance Count
 Tail Length (msec):

Memory Settings
 Host I/F Address:
 Prog Mem Adjust:

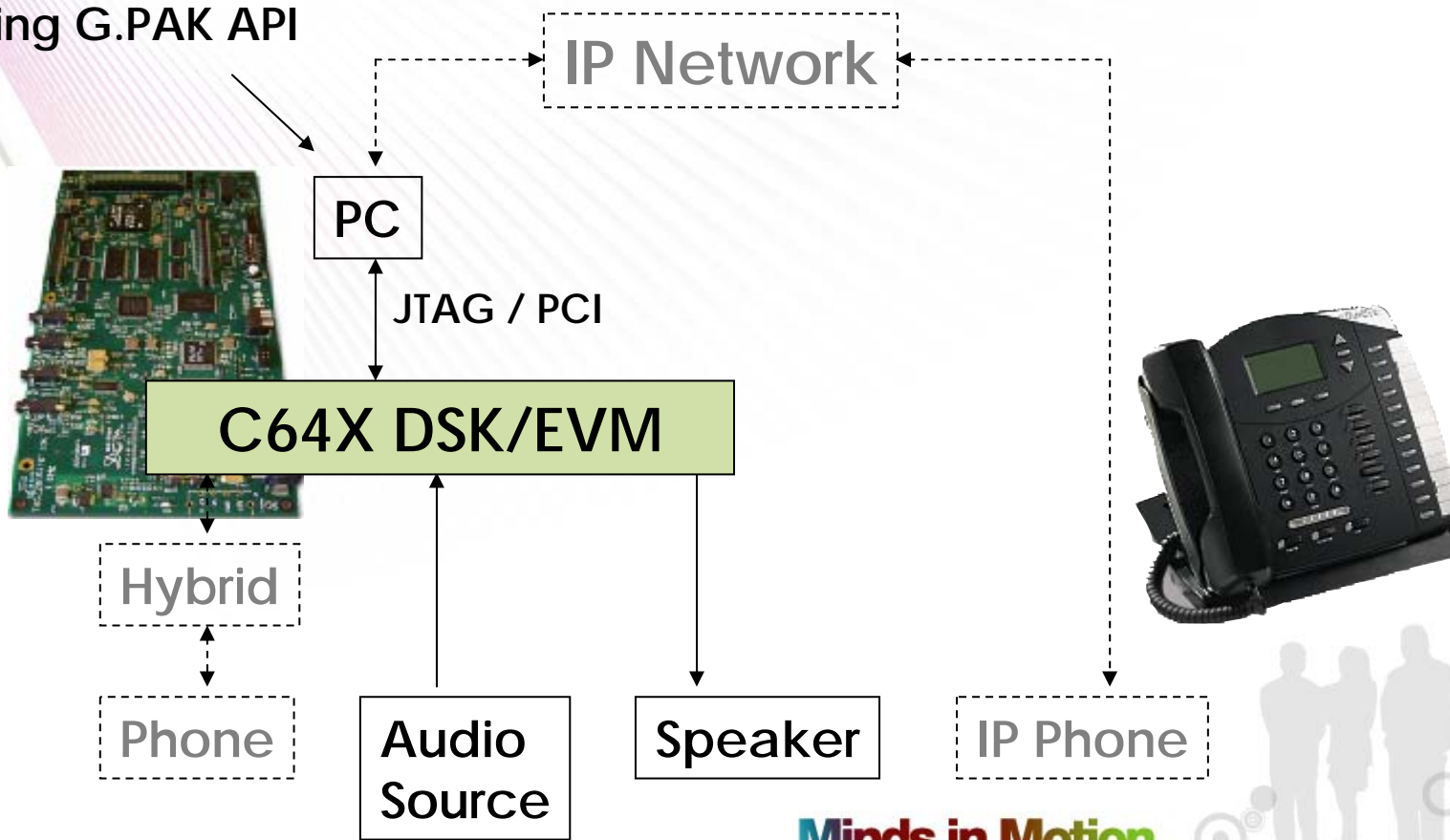
T.38
 Instance Count

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G.PAK Demo

G.PAK 演示

PC Emulates
Host Processor
Running G.PAK API



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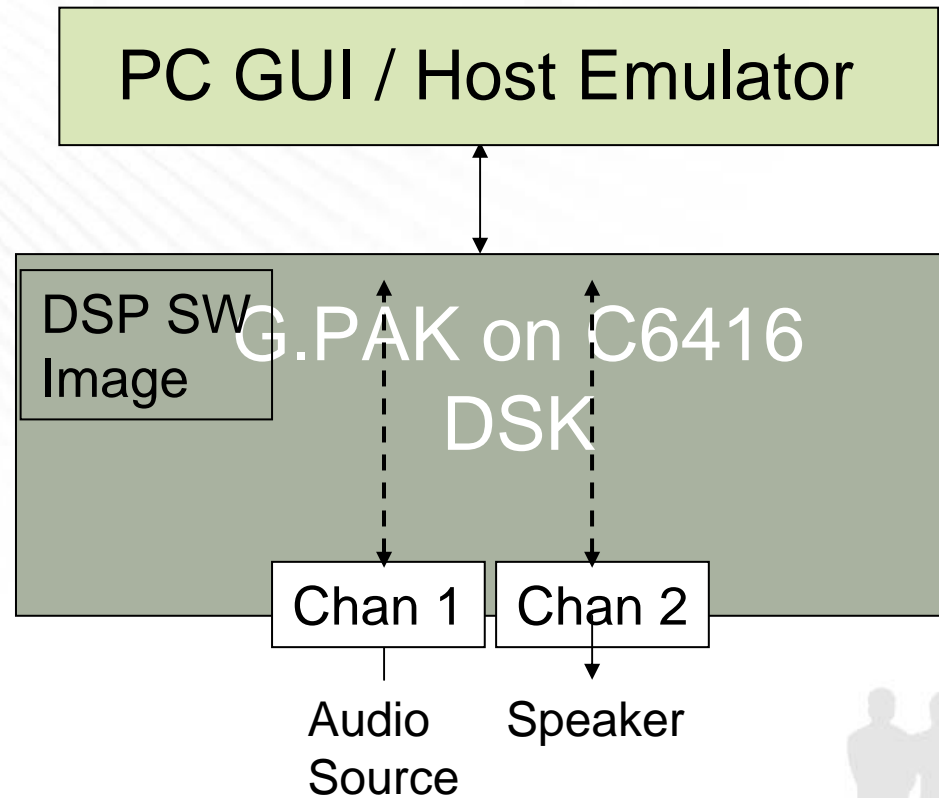
VoIP G.PAK Demo

VoIP G.PAK 演示

Download
程序载入

Setup McBSP
串口设置

Setup Channel
通道建立
(PCM to Packet)



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Summary: How Do We Close the Voice Quality Gap?

总结：如何提高话音质量

- Mitigate The Effects of VoIP Impairments
弥补VoIP系统的不利影响
- Use Wideband Audio
使用宽带声音信号
- Use Algorithms That Work Together
使用集成处理算法
- Package it all in ASSPs To Achieve Fast Time To Market
可载入ASSP软件加快进入市场速度

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TI | Developer Conference

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President



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610-825-0182

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 TEXAS INSTRUMENTS