Modem/Audio Integration
Concurrent Audio And Modem Acceleration

Dr. Rob Maher
Engineering Manager
AudioPCD/CABU
3Com Corporation
Outline

- Introduction and Scope
- Impact of Audio/Modem Acceleration
- Features and Cost Considerations
- Scalable Signal Processing
- Conclusions
Introduction

Acceleration means...

- Hardware optimized for function
- Quality of service
- Reduced impact on other system resources = better user experience
- Cost for the accelerator silicon
Product Requirements

Concurrency is essential today...

- Modem functions (V.90, fax, voice)
- Audio functions

...and tomorrow:

- DSL
- Streaming video
- Speech recognition/synthesis
- Advanced audio codecs

A programmable accelerator makes this possible
User Expectations

- Excellent value (quality/price)
- Easy installation and widespread compatibility (fewer support calls!)
- Demonstrably better performance and reliability
- Upgrade potential
Features And Cost Considerations

- Simultaneous acceleration of DirectX® audio APIs with hi-fi hardware sample rate conversion and mixing
- V.90 data/fax/voice modem
- Scalable signal processing to utilize host MIPS, but only when necessary
- Cost delta vs. fully soft audio/modem and AMR: $5 - $15 depending on range of features
Performance Impact
(Ref: PC 98 section 17)

- Game audio
  - 24 voice Synthesizer at 22 kHz: 12 MHz
  - 8 channel HRTF 3D at 22 kHz: 28 MHz
  - Total: 40 MHz

- Soft modem
  - Typical designs cost 60 MHz in training, and drop to 40 MHz in transmission
  - Total for concurrent operation: 90 Mhz, 30% of a minimum PC 99 PC
Accelerator Economics
(1 of 3)

- Assuming:
  - The previous slide is a representative load
  - A minimum PC 99 CPU (300 MHz) costs $63
  - An accelerator costs about $10
  - Spending 30% of the CPU on concurrent 3D audio and modem costs about $19, while in use
  - This analysis changes constantly, because CPU prices follow Moore’s Law
  - The conclusions don’t change, because Moore’s law applies to DSPs, too
Accelerator Economics
(2 of 3)

- Hardware-software migration is possible for other system components and applications
- Save the CPU MIPS for:
  - Soft DVD
  - Graphics intensive games
  - Videophone codecs
  - IP network security processing
    - Encryption for secure commerce
    - VPNs for secure connection from home networks to corporate networks
PC OEMs report average support call rates of 28%

Soft audio and modems work, but they are still vulnerable to long latency events.

These rare events may cause support calls:
- If they break a modem connection
- If they introduce irritating audible noise

Soft devices present a new challenge:
- Will the net additional support calls cost more in dollars and customer goodwill than the saved material cost? The customers will tell us.
Scalable Signal Processing

- Provide maximum performance and broad range of features
- Assign priority to using accelerator resources first, then use host only as necessary
- Algorithms can utilize all available resources to minimize “captive” costs
- Active load monitoring allows optimal resource allocation
Fully Scalable Algorithms

- Algorithms run on accelerator or host
- Algorithms can scale their resource usage
Conclusions

- Acceleration offers demonstrably increased performance and reliability.
- A modest CPU plus audio/modem accelerator can provide lower overall system cost with performance equivalent to a more expensive CPU.
- Scalable signal processing provides the best of both worlds.
Call To Action

- Understand the economic analysis of audio/modem acceleration
- Consider the total cost of ownership (BOM, support calls, etc.) when choosing between soft and accelerated architectures
- WDM is designed to support accelerators: Use it!