Optimized DSP Software • Independent DSP Analysis

Consumer Media Products: Trends and Technologies

(Workshop 206)

Berkeley Design Technology, Inc.
2107 Dwight Way, Second Floor
Berkeley, California 94704
USA
+1 (510) 665-1600

info@BDTI.com
http://www.BDTI.com

Key Technology Trends

- Processors
- Codecs
- Connectivity
- Convergence and complexity
- DRM
- Storage
- OSs

from Hifi.com

Processor Options Multiply

Today's CE designers have a wealth of options

- GPPs
- DSP processors
- Media processors
- ASSPs
- ASICs
  - Customizable cores
- FPGAs

Heterogeneous architectures increasingly common

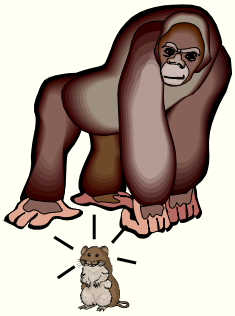
More… and Fewer

More speed across the board → more options

- Many processors adding multimedia capabilities
  - E.g., ARMv6 ISA includes video-oriented instructions
- Processors stealing work from dedicated hardware
  - E.g., 'C64x can handle broadcast-quality H.264 decoding

But architecture consolidation is likely

- Faster mainstream architectures reduce need for specialized architectures
- Weak markets kill niche players
- Barriers to entry rising
  - Availability of tools, software, and programmers often crucial

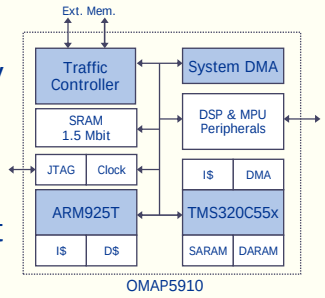


Processor Trends

Increasing integration
- More peripherals and on-chip memory
- Multi-chip packaging

Programming models more complex
- Increases reliance on tools
- Off-the-shelf software more important
- Software frameworks start to matter
  - Reduce need to re-invent the wheel
  - Improve interoperability of third-party IP

Memory system increasingly important
- Impacts performance and programming complexity
- Large, complex memory needed for emerging apps



OMAP5910

Who are the Winners?

Connected devices → GPPs
- Network stacks, OS, etc. readily available
- Cheap and powerful enough for many applications

Connected devices → "component" ASSPs
- Get needed performance but retain flexibility
- May contain a GPP that can support connectivity and other features

Mature, high-volume devices → highly-integrated ASSPs
- Driven by cost and power pressures
- May contain a GPP, DSP, or both
- Example markets: portable audio, DVD players

Processor Challenges

Maximizing integration while retaining flexibility

- Immature products have unstable feature sets, making ASIC investment risky
- "Mature" products may take on new features
  - For example, CD players are adding MP3 support

Hitting the right balance of features, cost, power consumption, time-to-market, ...

- Each approach has tradeoffs; for example:
  - ASSPs make it easier to hit cost targets
  - General-purpose solutions enable differentiation

 7

Codecs Keep Coming

Higher compression ratios of latest video codecs enable a range of new products and services

- Red-laser HD-DVD
- Broadcast-quality streaming video over cable/DSL
- Portable video "jukeboxes"

Audio codecs are adding new capabilities

- Multi-channel audio, e.g., 5.1-channel in WM9
- Higher-fidelity, e.g., MP3pro

DRM features are still evolving, but are beginning to get use by content providers

- press*play* uses Windows Media DRM
- MovieLink uses both Windows Media and RealNetworks DRM

 8

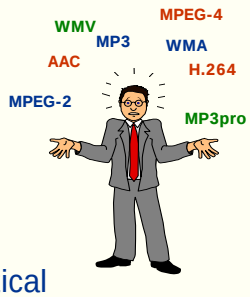
Who are the Winners?

Audio codecs are relatively stable
- MP3 is the clear winner; WMA also popular
- Compression suffices for today's storage, bandwidth
- Will MP3pro, AAC, etc. rock the boat?

Video codecs still a tossup
- MPEG-2 is long in the tooth, but widely used
- MPEG-4 has struggled; is this its year?
- H.264 is garnering a lot of interest
- Windows Video is expanding its reach
  - Microsoft is licensing codecs, DRM to non-MS platforms
  - Studios drawn to DRM features
- RealNetworks hanging on thanks to content and DRM

 9

Codec Challenges



The number of codecs is staggering
- A continuing stream of new arrivals
- Old codecs still must be supported
- A single codec may contain numerous algorithms, resolutions, frame rates, ...
  - What is "MPEG-4?"

Winners are still unclear, so flexibility is critical

Which device does the decoding?
- Possibilities include a PC, a set-top box, the TV, ...

As codecs becoming more bit-efficient, they also tend to require more processing resources

 10

Evolving Connectivity Model

Today, connectivity is highly PC-centric
- ↑ Easy to add features, services
  - Insecure environment for DRM
  - PCs are not consumer-friendly

All-in-one devices are emerging
- ↑ Eliminate PC
  - More components → higher prices
  - May depend on content provider

Future: content-capture devices + thin playback devices
- ↑ Low cost
  - Complex content distribution model

 11

Connectivity Solves Problems...

Personal content—the next big thing?
- Requires easy movement of audio, video, and images

Improving connectivity enables new products...
- CD-quality audio over Ethernet, Wi-Fi, ...
- HD-quality video over 1394b, DVi, ...

...and makes existing products more palatable
- Fast connections needed to cope with increasing storage of portable devices
- USB plug-and-play features simplify transfers
- Wi-Fi increases appeal of devices like digital audio receivers

 12

...But Creates Others

Physical and logical options growing
- USB, Wi-Fi, 1394, DVi, S/PDIF, Bluetooth, ...
- New choices continue to appear, yet backwards-compatibility is crucial

Most options not designed for multimedia
- Network set-up too complex for most users
  - Wireless networks are particularly unfriendly
- Weak connection management impedes distribution
- File storage is not standardized

Connectivity problems may appear only when the system is stressed

Convergence: Not Just a Buzzword

Fast processors, large memories make features cheap

Portable devices lead the convergence trend
- MP3 players adding video and photo features
- Recording capabilities becoming common
- Cell phones and PDAs adding media capabilities

PC/TV convergence finally becoming a reality?

Subtler forms of convergence abound
- MP3 spreading to automotive, home stereo, ...

Despite advances, unsettled standards continue to slow progress
- Disagreement over digital rights management is a big problem

Challenges for the Designer…

Convergence increases design complexity
- Complicates both software and hardware
- Requires coordination of design teams
- Introduces tough partitioning decisions
  - E.g., run video on the main processor or on a coprocessor?

New features can "ripple" through design
- E.g., adding video may impact memory system, I/O, ...

Off-the-shelf components increasingly important
- ASSPs, chip sets, and reference designs
- Software and hardware IP

Integration is a key challenge

"Femme se coiffant"
Pablo Picasso, 1940
Source: Jan Rabaey, Berkeley Wireless Research Center

…And Frustration for the User

User interfaces often weak; users need:
- Quick, easy access to key features
  - Advanced features must also be accessible
- Familiar look and feel
- Ability to locate media

Overabundance of connectivity options creates confusion
- Incompatibilities slow acceptance
- Set up can be a nightmare

Convergence increases speed of obsolescence

"De-convergence:" Next Big Thing?

Use PC or other device as central repository
- Much content already on the PC
- Reduce device costs:
  - Avoids duplicating features
  - Reduces need to support multiple codecs, file formats, etc.; PC can do trans-coding

Non-PC media server has obsolescence risks
- May depend on content provider
- Hard to upgrade
  - Increases dependence on single vendor

Added system complexity invites bad user interfaces

Highly dependent on consumer-friendly networking

 17

Conclusions

Enormous selection of processors
- Development infrastructures key to confronting growing processor, application complexity
  - Quality of tools, availability of software
- Many architectures won't survive
  - GPPs displacing competing technologies
  - Heterogeneous processors expanding
- Integration continues to increase
  - Balancing optimization, flexibility a key challenge

New codecs continue to emerge
- Audio codecs stabilizing, but video still unsettled
  - MPEG, Microsoft pulling away from the pack
- DRM remains a key challenge

 18

Conclusions

Connectivity options evolving quickly
- Personal content emerging as key driver
- System model quickly evolving
  - Removing PC complicates the picture
- Setting up, managing networks is problematic

Convergence is finally happening
- Most of the action is in portable devices
- Convergence greatly increases design difficulty
- User interfaces are a key challenge
- "De-convergence" happening in parallel

For More Information...

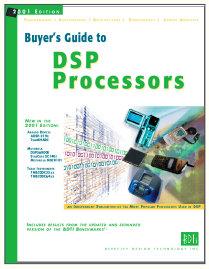
www.BDTI.com

Free Information
- BDTImark2000™ scores
- *DSP Insider* newsletter
- *Pocket Guide to Processors for DSP*

White papers on processor architectures and benchmarking

Article reprints on DSP-oriented processors and applications
- *EE Times*
- *IEEE Spectrum*
- *IEEE Computer* and others

comp.dsp FAQ



2001 Edition