



Trends and Tools for DSP Software Development

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Outline

- Things we all know about DSP's
- Some implications that can go overlooked
- History of DSP software development tools
- Guide to successful software development
- eXpressDSP
- Blackhawk™ Tools
- Summary

What We All Know About DSP Chips

- Rapid increase in DSP compute power
 - 4 MIPS/mW ('C5510) -- one AA NiMH holds 1400 mW-hrs
 - 30 MFLOPS/\$ ('C6711, 'C33)
 - 900 MFLOPS/in² ('C6711) -- 256 pin BGA is 2% of one side of PCI card
- Explosion of DSP based product designs
 - Over \$2 Billion in design ins for 'C2000 since 1997
- DSP-based System-on-a-chip roadmap to three trillion instructions per second by 2010

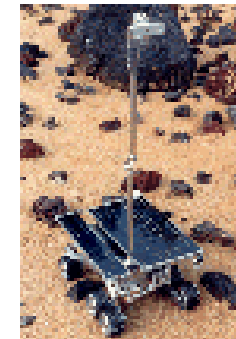
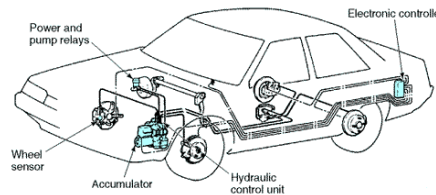
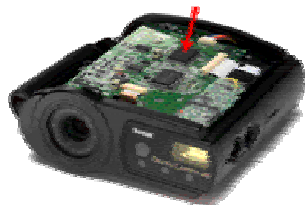
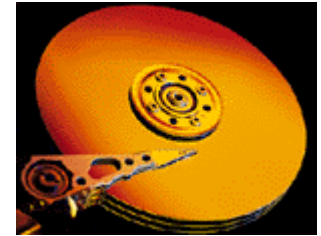
Application Areas for DSP Based Products

- Audio
- Automotive
- Cable Modem
- Computing
- Control Systems
- Digital Camera
- Digital Motor Control
- DSL



- Home Automation
- Imaging/Video
- Industrial
- Internet Music
- IP Telephone
- Medical
- Military
- Networking

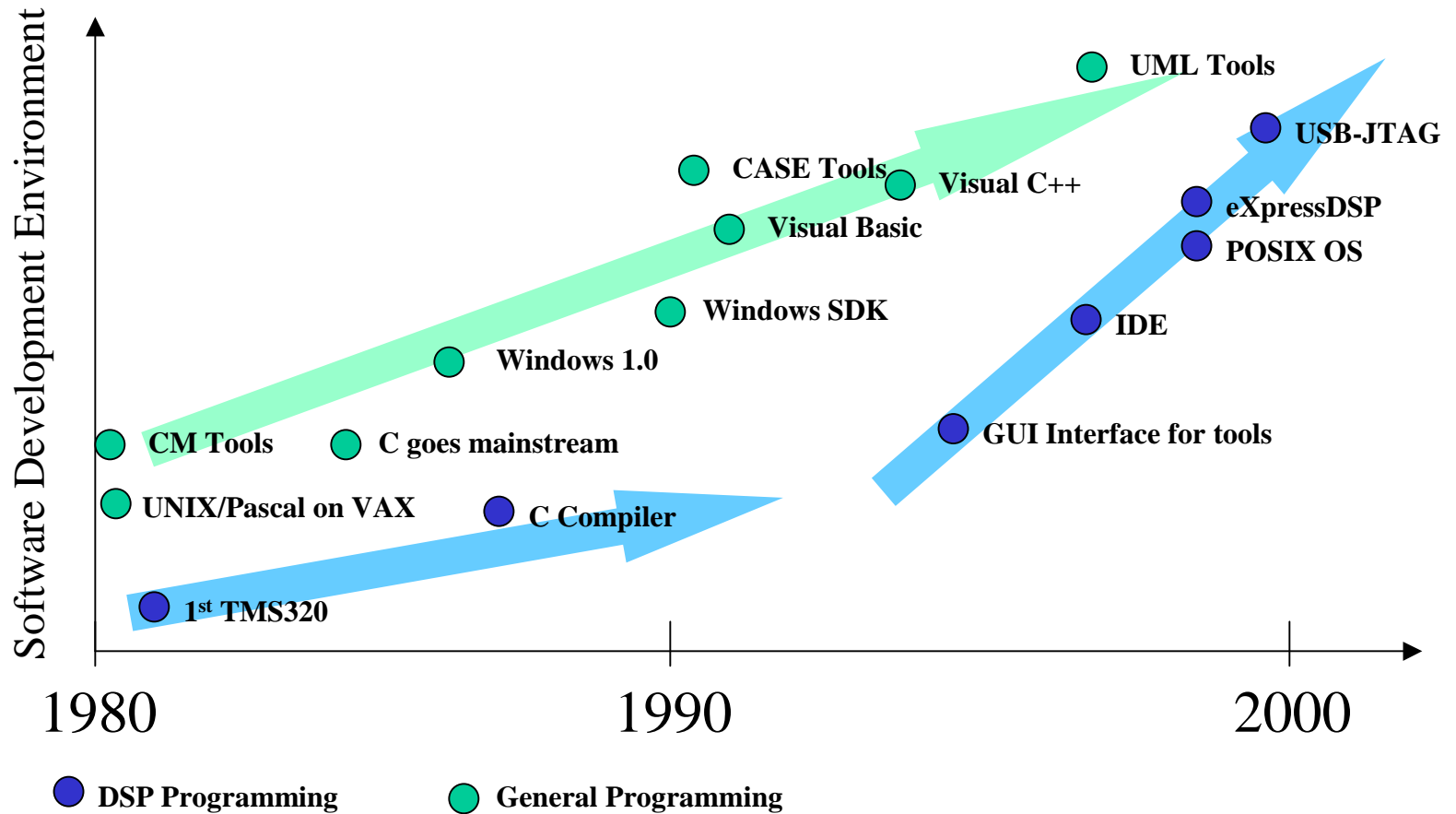
- Printing
- Storage
- Telecommunications
- Remote Access Servers (RAS)
- VoIP
- Wireless



What Is Sometimes Overlooked

- However, the most significant advantage of the latest round of DSP's may not be what products can be designed around them but rather how quickly these new DSP based products can be brought to market.
 - Concept to market in 7 months
 - 8 of top 10 wireless communications equipment manufacturers are designing 'C6000 into 3G base stations
 - TI DSP's are designed into 19 next generation portable audio players due to be released this year
- All new electronic products rapidly become commodity items
 - Your competitors will match your products performance
 - Every day saved on time to market is one more day of premium pricing

Brief History of DSP Software Tools



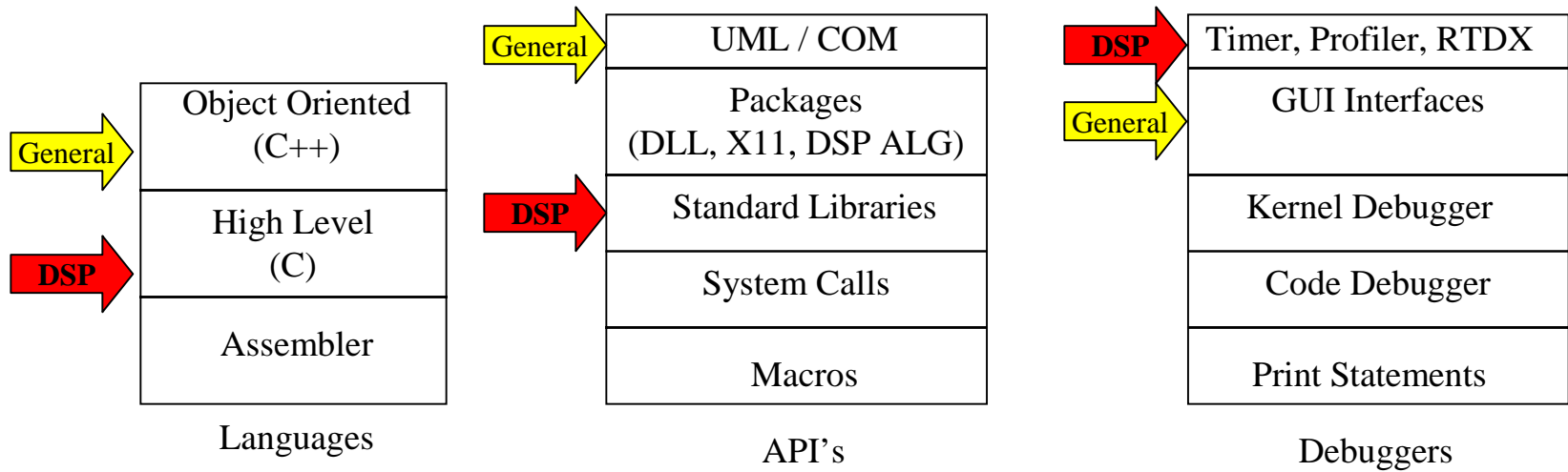
Future of DSP Software Tools

- What it means for tool development to be guided by available DSP power and time to market pressures
 - More efficient use of programmers time
 - Better code re-use
 - Easier integration of off-the-shelf components
 - Reduced reliance on specialized personnel

- The result
 - Higher level API's
 - True code generation
 - Version control tools
 - Abstraction from chip particulars
 - I/O libraries for peripheral chips
 - Standardized host-target interfaces
 - Knowledge bases
 - Developers networks
 - Modeling languages
 - Design patterns

Trends in Tool Use

- DSP software developers are moving into tool sets that provide more of the conveniences that general purpose developers enjoy.
 - Buying bundled tool sets
 - Attending affordable training
 - Coding on evaluation/reference hardware
 - Using integrated software components (OS's & Algorithms)



Guide to Successful Software Development

- Enable experienced DSP designers and programmers new to DSP to contribute to successful, rapid development of DSP based products.
 - Take advantage of integrated reference boards, operating systems, tools
 - Design products, don't invent fun problems to solve (apologies to the Educators track)
 - Know what's required vs. goals and when to stop
 - Make the right tradeoffs of performance vs. time to market
 - Don't be afraid to migrate up & down an IA family
- Stay informed and open minded about the availability and applicability of high level languages, real-time operating systems, standard libraries, visual tools and debuggers to your DSP based designs
 - Don't let your competition have an advantage in their development process

eXpressDSP

- TI's eXpressDSP Components
 - powerful DSP integrated development tools (Code Composer Studio)
 - a scalable, real-time software kernel (DSP/BIOS)
 - standards for application interoperability and reuse (TMS320 DSP Algorithm Standard)
 - a growing base of reusable third party software modules from the TI third-party network
- A Third Party Member's View of eXpressDSP
 - Chip vendor is committed to helping developers reduce time to market
 - Better to consider eXpressDSP as a philosophy rather than as particular components
 - Delicate balance of unifying tools and incorporating third party creativity



Blackhawk POSIX Compliant Operating Systems

- Characteristics of Blackhawk™ DSP Operating Systems
 - Multithreaded
 - Real-Time
 - UNIX-like interface (POSIX standard)
 - Virtual terminal and host file system utilities
 - Compatible with TI code generation and debug tools
 - Licensed Copy of Source Code
 - Open source libraries
 - ‘C3x, ‘C4x, ‘C2000, ‘C5000, ‘C6000 support



Blackhawk USB-JTAG Emulators

- Characteristics
 - Support for ‘C2000, ‘C5000, ‘C6000
 - “bus powered” USB peripheral
 - Member USB-IF
 - Code Composer Studio drivers



Blackhawk DSP Reference Boards

- All of the newer TI Instruction Set Architectures (C2000, C5000, C6000)
 - Reference module is an external USB peripheral
 - On board JTAG controller
 - Industry Pack Sockets for additional I/O
 - SRAM and FLASH
 - Logic Analyzer ports
 - Board Support package for Blackhawk™ DSP Operating System
 - Host computer (PC) utilities for file systems and virtual terminals



- Quad ‘C44 PCI Card
- Dual A/D, D/A
- Industry Pack Sockets
- SRAM and FLASH
- Board Support package for Blackhawk™ DSP Operating System
- Host utilities

Things to Consider Before & During Development

- DSP software development is difficult, specialized work
 - unless you have the right tools
- Efficiency is everything when designing a DSP based product
 - if you define efficiency in terms of your ability to get your product out the door faster, better, cheaper.
- DSP designers don't need shrink wrapped tools available at the corner store with advertised pricing
 - as long as they can get immediate pricing, in stock items and overnight delivery
- The critical part of getting DSP incorporated into your product is the code and debug phase
 - once you get to that point and if someone else is responsible for the remainder of the life cycle
- By its nature, Embedded programming is much harder than Windows programming, and DSP is much harder than other embedded apps.
 - When you're in need of a pay raise

Summary

- DSP's can and will be the power behind really exciting products
- Time to market can become an advantage
- Investigate the availability and applicability of new tools and methods
- Enable your software designers to be successful at product development