DSP Systems Technology for Innovators

Kun-Shan Lin
Vice President
Texas Instruments
25 Years Ago, TI Introduced TMS320C10

- 3 Microns
- 55K transistors
- 4K RAM
- 5 MIPS
- kHz applications

Small, but promising market...

Source: Forward Concepts & WSTS
DSP Market Has Grown Significantly

DSP Systems Technology Innovation

Customer Application Innovation

Source: Forward Concepts & WSTS
DSP Application Design Challenges

- Cost
- Low Power
- Increased Performance Demand
- Feature Flexibility
- Time to Market
To Meet Design Challenges, DSP Innovates in….

- Performance
- Power Dissipation
- Price (Chip, System)

TMS320
Semiconductor Process Advances
Power Dissipation Trends

Gene’s Law
DSP Power

Year

mW/MMACs


1,000 100 10 1 0.1 0.01 0.001 0.0001 0.00001
Innovation Examples: Driving Performance and Power Savings
TI Drives Innovation for Communication Infrastructure

Performance

- Increases channel density by 3x
- Over 500 G.711 Channels
- Over 250 G.729 Channels

Power

- 6 C64x+ DSP cores @ 500 MHz allows performance at lower voltage
- Large Shared L2 memory and next generation peripherals reduce system power dissipation
TI Drives Innovation For 3G/4G and WiMax Baseband

**Performance**
- 3 C64x+ cores @ 1GHz to increase raw DSP performance by 3x
- Integrates Accelerators for 3G baseband
- High performance platform for WiMax

**Cost**
- System Integration reduces WCDMA base station bill of materials by 5x

**Power**
- SmartReflex™ power management reduces power consumption by 2x
TI drives both DSP chip and system cost reduction.
Innovation Examples: Driving System Cost Reduction Through SOC Integration
DaVinci Drives Performance and Cost Savings for Video Systems

Performance
- 900 MHz C64x+ Core and Video Accelerator
- Single Chip DVR with 8 Channels MPEG4 Encode

Applications
- DVR, Video Infrastructure, IP Set-To-Box

Cost
- 2X cost reduction in 8 Channel Security DVR

Flexibility
- Programmable C64x+ DSP, Gigabit EMac Switch, and Video Codecs
DaVinci™ for Cost Sensitive Video Applications

Cost
- Sub-10$ 64x+™ today
- We will drive to $5 C64x+ in the future

Application
- Video Phone, IP Security Camera, DMA, Low Cost Video Card

Flexibility
- Full 8 MAC C64x+ Programmable DSP
- Video Port and EMAC
DaVinci™ Optimizes Performance, Power and Cost

Cost
- ~½ the cost of DM6446

Power
- ~½ the power of DM6446

Application
- Digital Camera, Portable Media Player, Photo Frame, Photo Printer
- MPEG4 / JPEG HW Engine
- Programmable Engine
  - Image stabilization
  - Red eye removal
  - Advanced noise filter
  - Panorama stitching
  - Real-time face recognition

Flexibility
- Arm926 processor
- MPEG4 and JPEG HW Accelerator
- Same Monta Vista Linux O/S and Coded Engine Framework as DM6446
DaVinci™ Software Offerings

Operating Systems & Device Drivers
- Linux OS preported to device
- Input output drivers tightly integrated into OS
  - Configurable
  - Robust, tested with EPSI APIs

Published Multimedia Application Programming Interfaces (APIs)
- Industry-recognized APIs
- DaVinci APIs (VISA, EPSI, xDM)

Codec Engine
- Codec abstraction
- Interprocessor communication
- DSP/BIOS™

Digital Media Codecs
- H.264
- MPEG4
- H.263
- WMV9
- VC1
- MPEG2
- JPEG
- AAC-HE
- AAC-LC
- WMA9
- WMA8
- MP3
- G.711
- G.728
- G.723.1
- G.729ab

Signal Processing Libraries
- Codec Kernels
- FIR, IIR
TI Is Committed to Technology for Innovators!

- DSP cores: high performance C64x+ and beyond
- GPP cores: Arm9, Arm11 and beyond
- Hardware accelerators: video, voice
- Industry popular peripherals
- Low power technology
- Multi-core DSP and single-chip DSP SOC
- Software infrastructures: Framework, AV engines, codecs, API
- Development tools, BIOS, third parties & university program
Price Elasticity vs. Market

MARKETS
- MILITARY
- LAB
- GRAPHICS
- INDUSTRIAL
- TELEPHONY
- CONSUMER

CHIP AUP
- $1000
- $500
- $100
- $50
- $10
- $5
- $1

ANNUAL CONSUMPTION
- 1
- 10
- 100
- 1K
- 10K
- 100K
- 1M

DSP CHIP
PRICE ELASTICITY

NOT DRAWN TO SCALE

SOURCE: FORWARD CONCEPTS

Technology for Innovators™
Customer Innovates on a $10 DSP

Integration (# of on-chip transistors) vs. Performance (MIPS)

- Digital Servo
- V.90 Data Modem
- Digital Cellular Phone, Digital Still Camera, PMP
- DSL Modem, Video Phone

$10 DSP

Technology for Innovators™
What Would I Create, If…

I had unlimited performance at my fingertips?

- **Cost** was not an issue?
- **Size** was not a problem?
- It could run off of **body heat**?
Thanks!