pLayer-i

An Internet based muzik player
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- Understanding and porting a widely used application
- Mp3 decoding is computationally very intensive and hence hardware usage would be a necessity
- Learning about a complete embedded application involving varied topics like DSP and networking

Our Motivation

What is mp3?

- Most widely used file-format and codec on earth and yet not too many people know its details.
- Complex Algorithm to compress a *.wav to *.mp3 by 10 times
- Lossey algo but based on human ear response

- Using a very primitive RTP-RTSP 2250 protocol
- Reason being ease of decoding the UDP frame
- Using the FPGA’s Ethernet Chip and a computer to feed the live stream

Networking

- Understanding the mp3 decoding scheme
- Writing a complete software version to eliminate ambiguity
- Timing Analysis
- Making Necessary Hardware Blocks
- System Integration

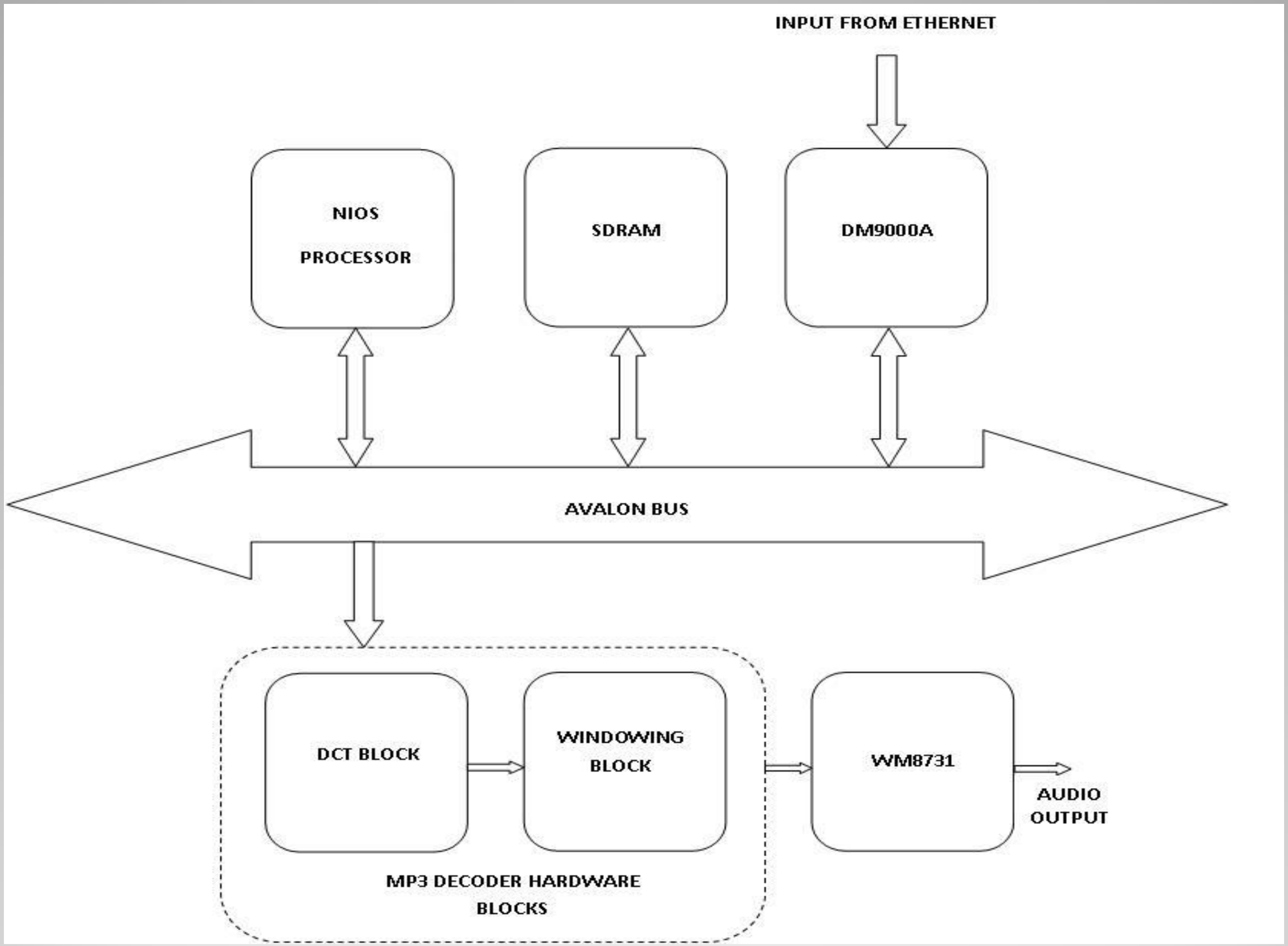
Our Approach

- Using the Spec sheet *ISO/IEC 11172-3 and a MPG123 library*
- A single file MP3 player was written and tested on our computer
- The file has no floating point calculation and uses no library
- This perfect-for-NIOS code was now ported on the NIOS….it worked!!
- This code “worked” but not “real-time”

Software code

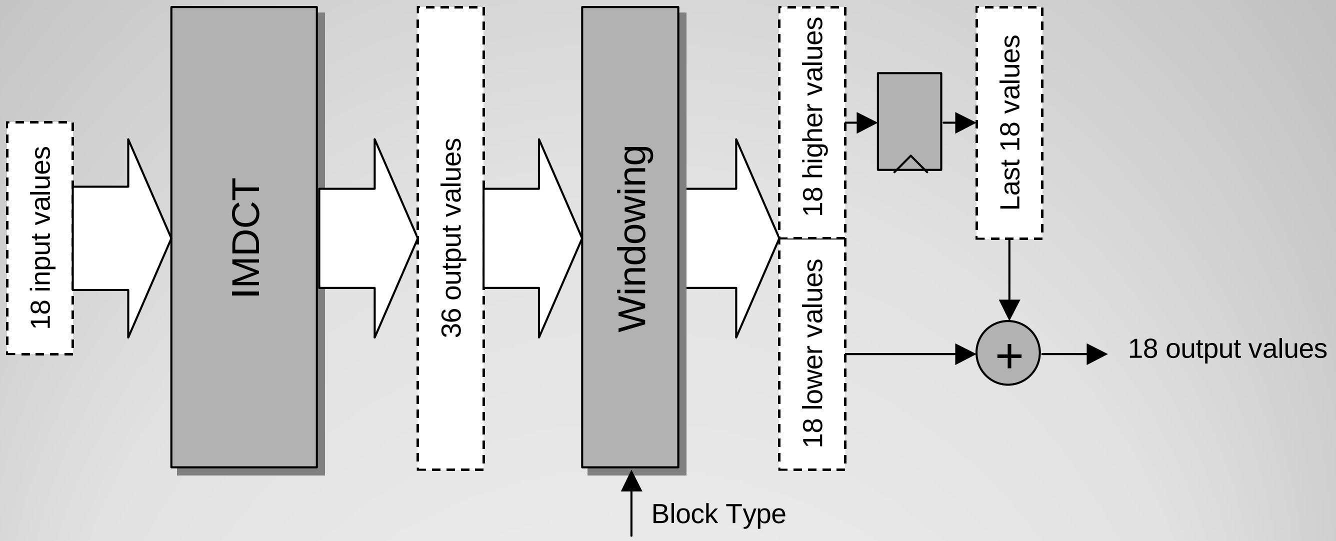
Timing Analysis

Details	Time
1 Mp3 frame	26ms
Full Software Decoder	245 ms
Software + Hardware DCT	185 ms
De-quantize + Huffman	3.5 ms
Anti-alising + Re-ordering	35 ms
IMDCT + Windowing	157 ms


INPUT FROM ETHERNET
NIOS
PROCESSOR
SDRAM
DM9000A
AVALON BUS
DCT BLOCK
WINDOWING
BLOCK
WM8731
AUDIO
OUTPUT
MP3 DECODER HARDWARE
BLOCKS

The System

- After the Timing Analysis, Obvious choice to make the last two hardware blocks:
  - IMDCT
  - Windowing



Hardware Blocks

Hardware Blocks

- IMDCT block saves around ** seconds in decoding.
- Windowing block saves around ** seconds
- Both made using pipelined architecture
- Problem in this is: Data Dependancy

- Unavailability of complete Specs
- Making the audio codec behave well
- Converting C to VHDL

RoadBLOCKS

- MP3
- Making Hardware
- Embedded Application Development

Lessons learnt

THANK YOU..