



Stanford Imagine Project Dual-Imagine Board Status



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The Dual-Imagine board provides a platform for architecture evaluation of the Imagine Stream Processor and for the development and testing of streaming applications. It supports two Imagines networked together and has Firewire and DVI interfaces for media I/O. Imagine's current peak performance is 11.5 GFLOPS at 288 MHz.

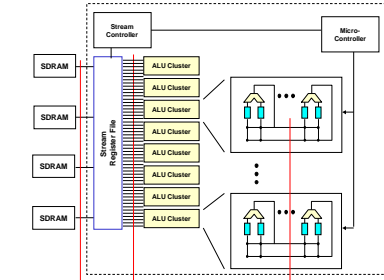


Figure 1: Imagine Architecture

Imagine's architecture is similar to a Streaming Supercomputer Node, with a similar bandwidth hierarchy, arithmetic clusters, and Stream Register File.

While the Streaming Supercomputer has a flat memory system shared among all nodes and operations for remote instructions such as fetch&op, Imagine's memory is not shared. Data is transferred between nodes on Imagine's source-routed 2-D torus network by explicit StreamSend commands.

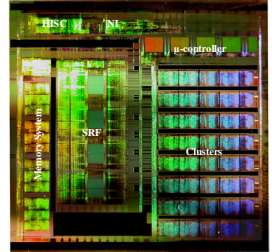


Figure 2: Imagine Die Photo

Single-Imagine Application Performance at 288 MHz

- Stereo depth extraction: 6.97 GOPS, 122 fps (320x240 8-bit grayscale)
- MPEG Encoding: 10.5 GOPS, 60 fps (720x480 24-bit color)

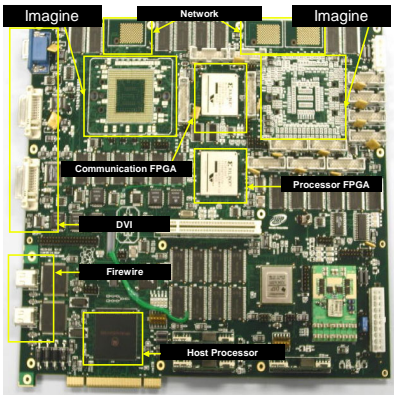


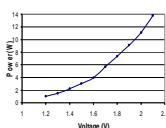
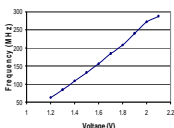
Figure 3: Dual Imagine Board

Dual Imagine Board Components

- **Imagine**
 - 48 32-bit ALUs on a single die
 - Data bandwidth hierarchy enables high computation rate
- **Network**
 - 800 Mbyte/s bidirectional Imagine Network
 - 4 ports per Imagine
 - On-board connections between both Imagines and I/O devices (via Communication FPGA)
 - Off-board connectors for interconnecting multiple boards
- **Host Processor**
 - PowerPC 8240 with PCI interface
 - Runs stream programs to sequence Imagine operations
- **Processor FPGA**
 - Interfaces Imagines to 8240's memory interface
- **Communication FPGA**
 - Controls Media devices (Firewire and DVI)
 - Translates Media I/O to Imagine network
 - Provides frame buffer for graphics rendering
- **DVI**
 - Digital Video Interconnect Input and Output
- **Firewire**
 - Two 40 Mbyte/s channels for camera input

Imagine Chip Measurements

- Current peak performance of 11.5 GFLOPS @ 288 MHz
- Most energy efficient at 1.2 V
 - 3.6 GOPS/W sustained (265 pJ/op)



Future Work

- Investigate Dual-Imagine operation
- Respin Imagine board to produce a standard PCI card-sized dual-Imagine system for distribution to research partners
- Build a 64-Imagine system to achieve 1 TeraFLOPS performance using 1-2 KW of power