FPGAs in 2008 and beyond
Peter ALFKE, University of Heidelberg, Germany
presented by Volker LINDENSTRUTH
alfke@sbcglobal.net    ti@kip.uni-heidelberg.de
including slides from Ivo BOLSENS

Agenda
• The FPGA Trends
• The Triple Play Opportunity
• The Platform Approach
• V5 News
• Conclusions

Twenty Years of Evolution
• 1988: XC3090
• 2008: XC5VLX330T
• 1000 times the number of LUTs
• 2000 times the number of configuration bits = complexity
• 20 times the speed
• 500 times cheaper per function, not counting inflation

Moore’s Law has been good to all of us!

FPGA Status
- More Logic Packing
- 6-LUT architecture
- Clocking Flexibility
  - DCM (precision synthesis) + PLL (Low jitter)
  - New PCI Express
  - Integrated Serial IO
- Faster Time To Market
  - Cross Platform Compatibility in “T” devices
- Greater System Integration
  - PowerPC 440 with crossbar and APU
  - Integrated Reliability
    - System Monitor
- Power & Performance
  - Low power 100Mbps to 3.2Gbps GTP
  - 150Mbps to 6.5Gbps GTX

FPGA Capacity Trends

FPGA Performance Trends

2013: 500MHz typical, 750MHz max
2007: 325 MHz typical, 500 MHz max
The FPGA Power Trends

- Total Power of Largest Device
- Cost Power Supply (Vccint)
- ITRS 2013: 25W

Price Per Logic Cell

- $/LC

The IO Bandwidth

- Optica
- Electrical
- Transition

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The Triple Play Opportunity

- Global Internet traffic will reach 44bn gigabytes per month in 2012, compared to less than 7bn in 2007
- Video goes from 22% of consumer traffic in 2007 to 90% in 2012
- Mobile data traffic will roughly double each year from 2008-2012

Backdrop: focus on reducing power consumption to reduce operating expense

Consumer Internet Traffic Analysis 2007-2012

- All Video: 49% of IP traffic
- Fastest growth: Video to TV
- Video Comm will be driver beyond 2012
- P2P is large portion of IP traffic: 33%
Triple Play: Key Technologies

1. Digital Signal Processing – Transforming data
2. Packet Processing – Transporting data
3. Tera Computing – Analyzing data

Wired Networking Trends

- The line rate is what drives the processing and input/output challenge on each line card
- The challenge is growing in step with Internet traffic growth

Wireless Networking Trends

- Longer-term trends:
  - Multi-mode radio and cognitive radio (increasing adaptability)
  - Mobility as a central feature of Internet (increasing demands)

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Bridging the Gap
Combining Xilinx FPGA Technologies with Software and Hardware to help the “Domain Expert”

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**Virtex-5 Common Features**
- 30% Higher Performance
- More than just a PPC440…

**Virtex-5 FXT Additional Capabilities**
- One or two PPC440 hard Microprocessor cores faster and more efficient than PPC405, super-scalar, larger caches, deeper instruction pipeline, integrated crossbar switch saves thousands of slices
- GTX High-performance Transceivers optimized for performance and low power and pcb-board signal integrity for an “open eye”.

**PPC440+128-bit FPU via APU**
- Soft co-processor module, free-of-charge accessible by the 440 processor instruction pipeline
- Single- and double-precision IEEE-754 compliant
- Speed-up 8 to 30 times, 200 MFLOPS sustained

**More Than Just a PPC440…**
- Four built-in DMA channels provide high-speed access to memory or I/O
- Separate memory and I/O buses greatly improve system performance
- External masters can access memory or I/O through the crossbar

**LEGO Mindstorms NXT**
- “The smartest, coolest toy of the year”
- 100’s thousands of students

**CERN Large Hadron Collider**
- “The most powerful instrument on earth”
- Engineering Team

**Standard Component Hardware and Backend Software**
- Consistent User/Demonstration Tools and COTS Hardware
- User/Domain ‐ level Software Tools and COTS Hardware

**I/O Bus (PLB V46)**
- Processor Block
- Memory Controller Interface
- External DDR2 Memory

**PPC440+128-bit FPU via APU**
- PowerPC440 +128-bit FPU via APU
- Soft co-processor module, free-of-charge accessible by the 440 processor instruction pipeline
- Single- and double-precision IEEE-754 compliant
- Speed-up 8 to 30 times, 200 MFLOPS sustained
8 to 24 transceivers per device (40 and 48 in TX subfamily)
Supporting data rates from 150 Mbps to 6.5 Gbps
Power dissipation less than 250 mW per channel
Programmable Tx pre-emphasis and Rx equalization

New Additions to the Family
- XC5VTX150T and 'TX240T
  - Like 'FX130T and 'FX200T minus the PPC microprocessor
  - but with twice the number of GTX transceivers
  - 40 and 48 GTXs respectively
- Availability: ES 4Q08, Production 1Q09

When you need lots of fast transceivers

Conclusions
- FPGA the programmable platform for
  - Transforming, transporting and computing digital data
- A trend towards specialized HW and SW to support programmable system solutions
- A strategy of working with Academics to enable exploration of new system applications & research
- Multi-gigabit transceivers are very popular
- Moore’s Law will give us much more logic and lower cost
  - Speed, power consumption, packaging pose a difficult challenge
- Users want and need to improve design productivity
  - The pace is becoming faster and more competitive.

Thank You