

NetFPGA: An Open Platform for Gigabit-rate Network Switching and Routing

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<http://NetFPGA.org>

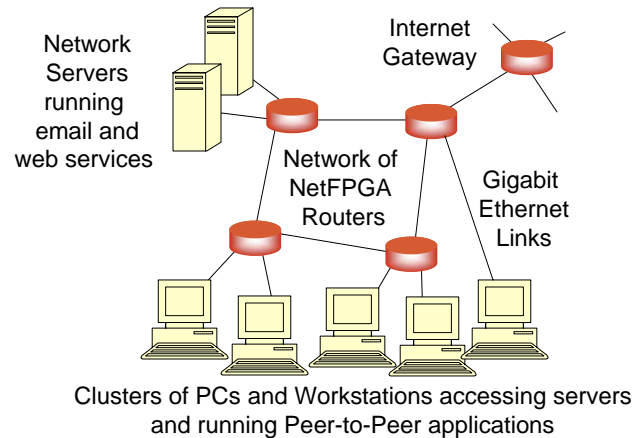


Motivation to Teach Network Hardware

- **Research and Education**
 - Students Today
 - Build network systems mostly with software
 - Students Tomorrow
 - Can quickly learn to also build system components in hardware
- **Interesting Topics for Networking Hardware**
 - Switching and Routing
 - Gigabit-rate networking
 - Network Security
 - Intrusion Detection and Prevention Systems (IDS, IPS)
 - New Protocols
 - Wire-speed Content Routing and Clean-slate designs



Intrenet Routing & Switching



Networking Hardware Education

- **CS344 Course @ Stanford**
 - Build an Internet router in 8 weeks
 - Hardware forwards packets
 - Software implements pw-OSPF
- **CSE565, CSE566 Courses @ WU**
 - Accelerate Networking algorithms in hardware
 - TCP/IP Flow processing
 - Build a Reconfigurable Networking System-on-Chip
 - Intrusion Detection and Prevension Systems

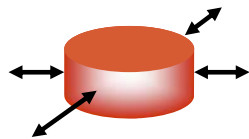


cs344: Build an Internet Router in 8 weeks

- **Stanford class offered Spring '03, '05, '07**
 - Laboratory utilizes NetFPGA hardware
- **Organized as student teams working on projects**
 - One hardware developer + one-two software developers
- **Results**
 - Students start with baseline
 - Two port learning Ethernet switch
 - pw-OSPF software
 - Students build
 - Four-port Gigabit-speed Internet Router
 - Hardware performs MAC address learning & IP forwarding
 - Software performs OSPF distributed routing



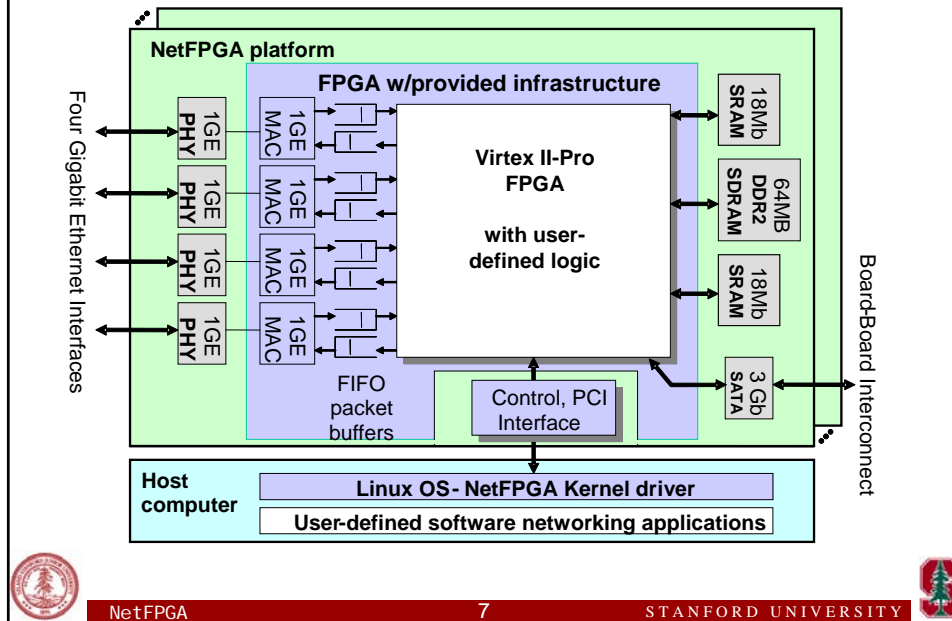
NetFPGA Platform



- **Function :**
 - 4 Gigabit Ethernet ports
- **Fully programmable**
 - Entire datapath in FPGA
- **Low cost**
 - Widely deployable platform
- **Open-source FPGA hardware**
 - Routing hardware base in Verilog
- **Embedded Software**
 - Host PC,
 - Embedded PowerPC, and/or
 - Soft-core LEON or Microblaze



NetFPGA Block Diagram



Details of the NetFPGA (ver 2.1)



- Fits into Standard PCI Host Interface
- Provides 4 Gigabit Ethernet Interfaces
- Enables hardware-accelerated processing of content using Field Programmable Gate Array (FPGA) logic & attached memory
 - Virtex-2 Pro FPGA
 - 4MB ZBT SRAM
 - 64MB DDR2 DRAM



NetFPGA Reference Development System

- **Chassis**
 - Open-window case
 - Thermal sensor on FPGA
- **NetFPGA**
 - Standard PCI Interface
 - Four Gigabit Ethernet Ports
- **Host NIC (optional)**
 - Two Gigabit Host Ports
 - PCI-Express bus
- **Processor**
 - Dual-Core Athlon-64
 - 2 Gigabytes DRAM
- **Operating System**
 - Linux CentOS 4.4
(or Fedore Core, RedHat ..)



Internet2 Machines - Tested fine with the NetFPGA



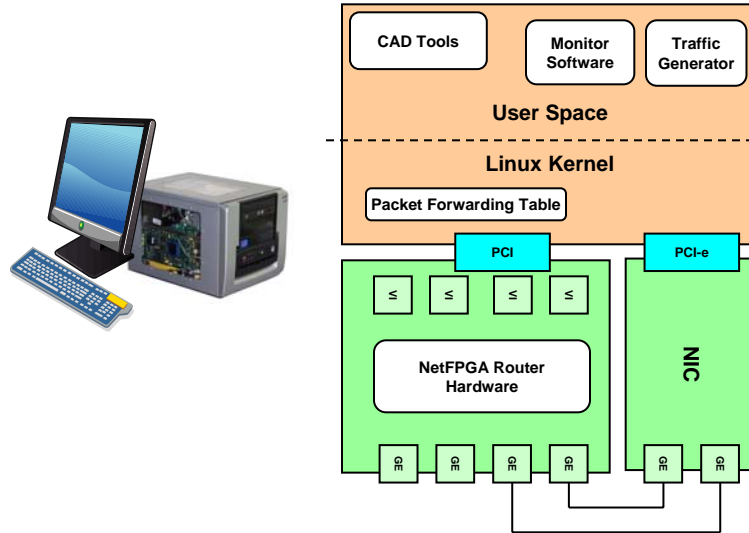
NetFPGA properly
recognized in PCI-X slot



Dell 2950
with PCI-X and PCI-Express Slots



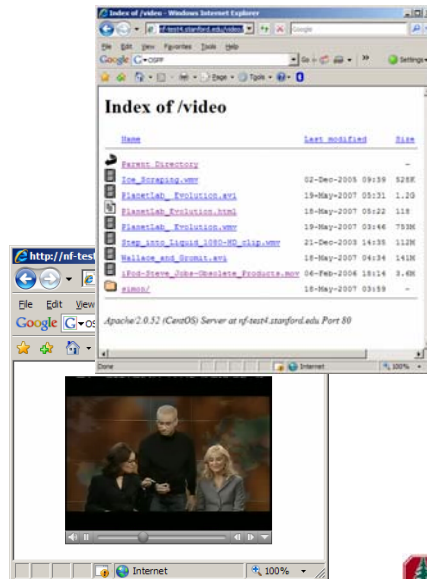
Hardware and Software View of System

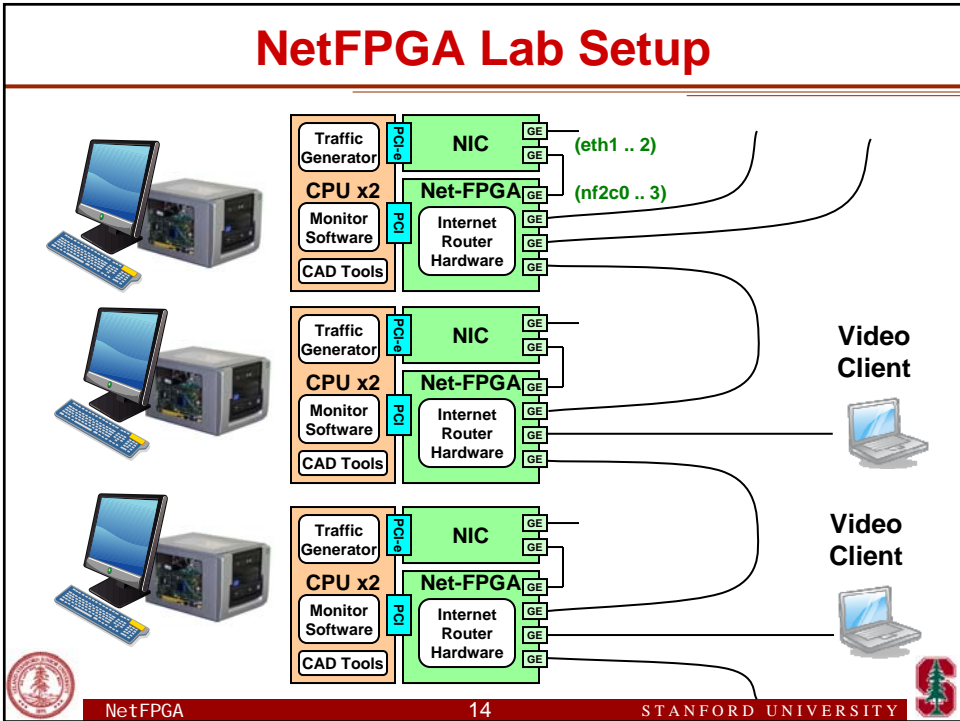
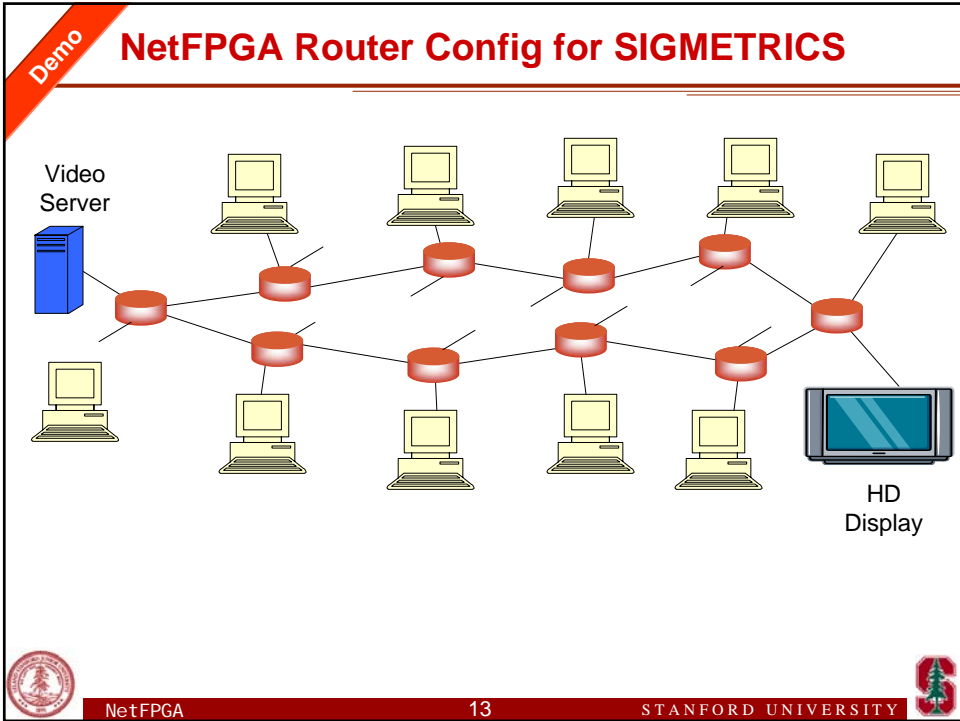


Demo

Streaming Video through the NetFPGA

- **Video server**
 - NetFPGA Router
 - Apache Web server
- **Video client**
 - Windows Media Player
 - Linux mplayer
- **Video traffic**
 - MPEG2 HDTV (35 Mbps)
 - MPEG2 TV (9 Mbps)
 - DVI (3 Mbps)
 - WMF (1.7 Mbps)





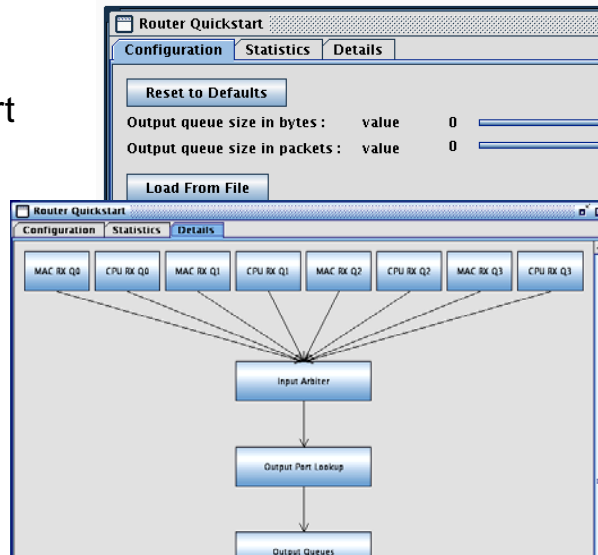
Explore Router Architecture with GUI

GUI Configuration

- Router Quickstart configuration

Reference details

- simple
- modular
- pipeline

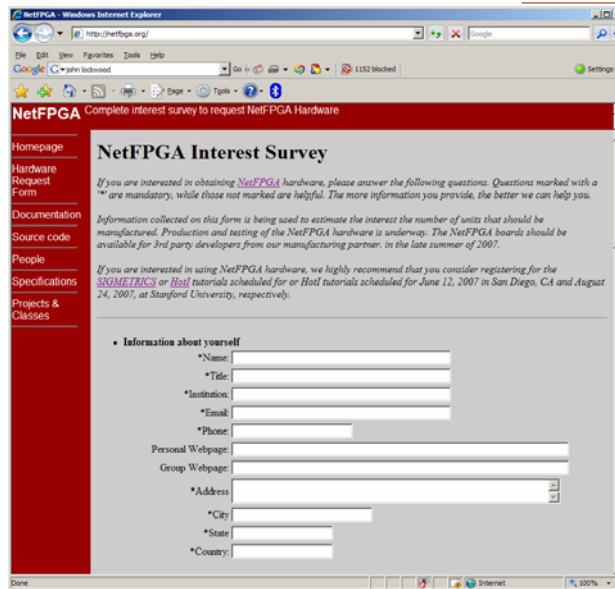


Project Homepage: <http://NetFPGA.org>

The screenshot shows the NetFPGA project homepage in a web browser. The page has a red header with the text 'NetFPGA Complete interest survey to request NetFPGA Hardware'. A navigation menu on the left includes links for 'Homepage', 'Hardware Request Form', 'Documentation', 'Source code', 'People', 'Specifications', 'Projects & Classes'. The main content area features a 'NetFPGA Overview' section with a diagram of a network topology and a paragraph describing the platform's capabilities. Below this is an 'Open Platform' section with a paragraph and a diagram of the NetFPGA platform architecture. The architecture diagram shows a 'Host computer' connected to a 'NetFPGA platform' via a 'Control, PCI interface'. The NetFPGA platform includes 'FPGA w/provided infrastructure', 'User-defined logic', 'Xilinx Virtex II-Pro 50 FPGA', 'FIFO packet buffers', and 'Control, PCI interface'. The host computer runs 'Linux OS - NetFPGA kernel driver' and 'User-defined software networking applications'.



Request Hardware: <http://NetFPGA.org>



The screenshot shows a web browser window titled "NetFPGA - Windows Internet Explorer" with the address bar displaying "http://netfpga.org/". The page content includes a navigation menu on the left with items like "Homepage", "Hardware Request Form", "Documentation", "Source code", "People", "Specifications", "Projects & Classes", and "Classes". The main content area is titled "NetFPGA Interest Survey" and contains the following text:

NetFPGA Interest Survey

If you are interested in obtaining NetFPGA hardware, please answer the following questions. Questions marked with a "" are mandatory, while those not marked are helpful. The more information you provide, the better we can help you.*

Information collected on this form is being used to estimate the interest the number of units that should be manufactured. Production and testing of the NetFPGA hardware is underway. The NetFPGA boards should be available for 3rd party developers from our manufacturing partner, in the late summer of 2007.

If you are interested in using NetFPGA hardware, we highly recommend that you consider registering for the SIGMETRICS or Hot tutorials scheduled for or Hot tutorials scheduled for June 12, 2007 in San Diego, CA and August 24, 2007, at Stanford University, respectively.

Information about yourself

- *Name:
- *Title:
- *Institution:
- *Email:
- *Phone:
- Personal Webpage:
- Group Webpage:
- *Address:
- *City:
- *State:
- *Country:



Upcoming NetFPGA Tutorials

- **SIGMetrics :**
 - Half-day Tutorial
 - June 12, 2007
 - San Diego, California

http://www.cs.cmu.edu/~sigm07/workshops.html#TUTORIAL_2
- **Hot Interconnects :**
 - Full-day Tutorial
 - August 24, 2007
 - Stanford, California

<http://www.hoti.org>
- **NetFPGA Homepage**

<http://NetFPGA.org>

