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Engineering

FIREEYEZ: THE DESIGN AND IMPLEMENTATION OF A BEOWULF CLUSTER MONITORING SYSTEM

by

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A Beowulf Cluster is a supercomputer constructed out of off-the-shelf personal computer systems that are networked in specific topologies. One of the challenges in utilizing the processing and communication capabilities of the cluster is in being able to evaluate the dynamic loading that occurs during the execution of general-purpose parallel applications. In particular, information on the utilization of each network connection and each CPU node is helpful in evaluating and tuning applications for future executions.

A novel, hardware-based monitoring system has been designed and is almost completely implemented. An engineering senior design team at Calvin College first proposed the structure of the monitoring system during the 2000-2001 academic year. During the summer of 2002, the design work was restarted with a number of significant changes to the earlier work.

The monitoring system features a PCI-compliant card that is placed in each of the nodes of the Beowulf Cluster (including the master nodes). These cards gather information on each network packet and information on CPU utilization that is passed down from the LINUX kernel. The cards are then connected together over a dedicated communication link to an additional monitoring computer. This station gathers information from each of the monitoring cards and passes the information to a graphical user interface running on the monitor station.

Key areas of design work include LINUX kernel modifications; PCI bus interface, printed circuit board layout, fabrication, and assembly; and digital logic design using VHDL for Altera FPGA (Field Programmable Gate Array) devices.

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