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STATUS OF FASTBUS SOFTWARE
IN THE COMPUTING DEPARTMENT AT FERMILAB*

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This paper presents the current status of FASTBUS software projects in the Data Acquisition Group at Fermilab. The Computing Department, which includes this group, supports software running under the PDP-11 RT-11, RSX and VAX/VMS operating systems. Fortran callable subroutine libraries are available to access FASTBUS through the IORFI-II, UNIBUS Processor Interface (UPI) and Lecroy 1821 Host Interface. The FASTBUS Diagnostic Language, implemented and supported at the University of Illinois, is used at Fermilab, where it has been converted to run under the VAX/VMS and RSX-11M operating systems. A first version of a FASTBUS database has been implemented which provides data to a program which automatically generates logical addresses and Segment Interconnect route tables.

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Introduction

The Data Acquisition group of the Fermilab Computing Department has responsibility for supporting the online computing requirements of experiments at Fermilab.

Historically, the group was involved in the specification of the Unibus (Fastbus) Processor Interface (UPI), the debugging and use of the prototype versions and support of the CDF Fastbus test stands before CDF was able to provide their own software support.

At present the group supports a few single Fastbus crate systems in experiments. Experiment 653, with 11 Fastbus crates of Lecroy hardware which is read out through 1821s into an PDP-11/23, provides its own FASTBUS software support; as does CDF for its multi-crate Fastbus system.

The group supports the goal of publishing software routine standards for FASTBUS. To this end, it is an active member of the FASTBUS Software working group; provided the editor of the first standard routine specification; has been active in the Revision Subcommittee; and is now collaborating in editing of the new Standard Routine Specifications.

Software for PDP-11s

An implementation of the April 1983 draft Specification for Standard Routines for Fastbus is provided for the PDP-11 RT-11 single job monitor, interfaced through the UPI running V5 of the microcode.

Dave Lesny of the University of Illinois has written an emulation of UPI Microcode V5 for the I/O Register to FASTBUS Interface (IORFI) interfaced through the DRV-11J to Q-Bus. The University of Illinois has also written and supports an interactive, diagnostic tool for Fastbus (the Fastbus or Device Diagnostic Language - DDL) which uses the 1983 Standard Routine Library. The PDP-11 test stands at Fermilab in general use the Fastbus Diagnostic Language, or Fortran programs which call the standard routine library directly.

An addition has been made to the Fermilab RT-11 Data acquisition program, RTMULTI, to allow specification of Fastbus operations in the list driven event readout. This also calls the standard routine library. This implementation has been used by CDF in a FASTBUS test stand. Experiment 400, an experiment in the Proton area at

Fermilab, read data from four 2-Mbyte FASTBUS memories using the routines directly from their data acquisition program.

The Standard Routine Library and the FASTBUS Diagnostic Language have been converted to run under the RSX-11M operating system - mapping directly to the interface I/O page registers, without a software driver.

VAX/VMS Support

The computing department provides a VAX/VMS device driver for the UPI. The driver supports both the UPI's Master Interface - the FASTBUS Segment Driver - and the slave FASTBUS Interrupt Receiver. The driver reads unsolicited FASTBUS Interrupt Messages and distributes them to connected processes.

A subroutine library implementing the April 1983 specification for standard routines has been implemented for VAX/VMS and the Device Diagnostic Language converted to run on the VAX. Extensions have also been made to the program for VMS and RT-11 to support access to CAMAC through the Jorway 411 CAMAC interface used at Fermilab.

FASTBUS Database/Route Table Generation

A database containing information on location, addresses, implemented Control Status Registers etc of FASTBUS devices has been implemented in DEC Datatrieve. A Fortran program has been written to generate the Segment Interconnect route tables and logical address assignments for an arbitrary FASTBUS system topology. VAX/VMS command files are available to provide an interface between the data base and this program. The program reads the segment topology, address requirements, slot and segment interconnect information for the FASTBUS system, and generates logical addresses for any modules requiring them. It constructs the route tables for the segment interconnects. Some parts of this system are used in the CDF online system.

Support for Lecroy FASTBUS Hardware

Several experiments at Fermilab are using Lecroy 1879 TDCs and 1885 ADCs, using the Lecroy Segment Manager/Interface to read out the data. At present the computing department supports control of the 1821 through the CAMAC 2891 interface. Data has been read out into an RTMULTI system, and into a VAX. Versions of a full diagnostic program for the 1821 are provided to run under

RT-11,RSX and VMS. A Diagnostic tool program to provide extended functionality testing for 1821 based systems is also available to run on the three systems.

Support for Microcode development is provided through access to a Microtec Metassembler, a definition file for the 1821 microcode word, and sample microcode programs.

E653 in the Neutrino area at Fermilab, does data acquisition from a FASTBUS system of 11 crates containing 50,000 channels of Lecroy ADCs and TDCs. The Physics Department at Ohio State University, a collaborator on that experiment, provided the microcode definition file. The experiment has implemented a device driver for using the Lecroy 1821 through a DR-11W to 1821/DEC interface on an RSX-11M system.

Future Plans

The Computing Department is committed to providing support for the Revised Standard Routines for FASTBUS. To this end we are converting the CDF VMS based implementation to run on our PDP-11s. This work is in the debugging stage. We are in the final test phase of interfacing the Device Diagnostic Language to the revised standard routines. We will install and support the SLD implementation for the IORFI interface on a Microvax.

In the next year we hope to write a VAX/VMS device driver for the Lecroy 1821 accessed through a DR-11W and intend to extend the standard routine implementation to support this interface to FASTBUS.

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The FASTBUS effort of the Fermilab computing department has involved many other people besides the authors of this paper. Al Brenner, head of the department up to a year ago, was involved in the original work to propose a new data acquisition bus standard, and encouraged the departments role and work in FASTBUS. Jeff Appel, the associate head, has allocated software and hardware resources to FASTBUS development. The Computing Department is continuing with its commitment for the support and development of FASTBUS. We acknowledge the contributions and collaboration with Dave Lesny at the University of Illinois, Ed Barsotti and Cathy van Ingen at CDF, for work on the IORFI and UPI software; Ron Sidwell and Toby Burnett for their work and consultation on the Lecroy 1821; and the summer and student employees who have worked on FASTBUS projects.