High-speed data transfer and recording system for BELLE (KEK-B) experiment

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We have developed a high-speed data transfer and recording system for BELLE (KEK-B) experiment in collaboration with Fujitsu and Fuji-Facom Control companies. The required speed for online recording is 15Mbytes/sec. Three 155Mbps optical transfer modules are used to obtain the required speed. The data are transferred in parallel and received by single workstation. The recording devices are attached to the receiver workstation through a FastWide SCSI interface. The control is performed through dedicated network. In this report, we will compare and discuss the design and measured performance of this system.

Key words: data transfer; recording system;

1 Introduction

KEK B-physics experiment, BELLE, reuquires a high-speed data transfer and recording system for central recording. The required recording speed is 15MBbytes/sec including software overheads. The data transfer system receives the data from online analysis farm which consists of six VME subsystems. The received data should be transferred to the recording system which is located in the computer center which is 2.5km far from the experimental hall.

2 Required Functions of the system

The schematic view of the system is show in Fig.1. The following functions are reuired for this system.

- Receive the event data from the online farm.
- Serialize the data for transfer.
- Transfer the data to the computer center which is 2.5km far from experimental hall.
- Write the data on the magnetic tape.
- Detect the near tape end and report it to the control system.
- Detect the system failure and report it to the control system.
- Receive the control commands from the control system and do the appropriate action.
- Answer the inquiry command from the control system.

For the communication between this system and the BELLE control system, we have developped network based communication program.

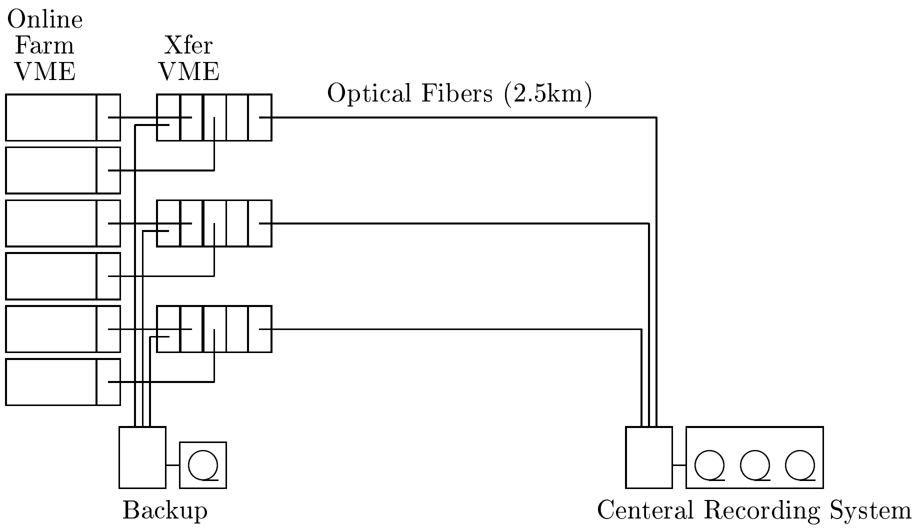

Fig. 1. BELLE data transfer and recording system

3 System components

To achive the required performance and functions, we have built the system from the following conponents.

For the data transfer from online farm to the transfer system, we have developped a memory link module. The memory link module is a pair of VME modules; one is sender and the other is receiver. The sender module is placed in the VME crate of the online farm.

To achive the required speed we have devided the transfer system into three independ subsystems. Each subsystem has the following modules in a 6U VME crate.

- optical transmitter module which sends the data to the receiver
- optical memory link modules which receive the data from online analysis farm
- VME controller

The I/O server, Fujitsu S-7/7000U model 300, which is placed in computer center, receives the data which is transferred through the three independent optical links. The I/O server merges the data and records them on magnetic tape. The tape drives are placed in the tape library, SONY PetaSite DMS-8800. Three tape drives are allocated for online data recording; in normal operation, two of them are used alternatively to reduce the loss time for tape exchange.

The interface between I/O server and the tape drive is a FastWide Differential SCSI, of which maximum transfer speed is 20Mbytes/sec. Although the maximum recording speed of the tape drive is 32Mbytes/sec (SONY DIR-1000), the interface limits the recording speed up to 20Mbytes/sec.

link module which copy the contents of the specified memory to the other module through optical-fiber.

4 Performance

The hardware and required performance are shown in table 1. The required performance are determined by taking into account of data size fluctuation and the bus sharing. We have analysed the timings and the overhead of each data transfer. The observed performance is in good agreement of these analysis.

Component	Hardware Performance	Required Performance
Memory Link Module	156Mbps	6.1Mbytes/sec
Data Transfer Module	156Mbps	8.7Mbytes/sec
Tape Drive Interface	20Mbytes/sec	15Mbytes/sec
Tape Drive	32Mbytes/sec	15Mbytes/sec

Table 1
Performance of each component

5 Conclusion

We have built a high-speed data transfer and recording system. The system consists of three transfer subsystems and is easy to upgrade by adding the subsystem. This system is also easy to modify to the parallel recording system. This feature may give us a solution to the recording problems for future large scale experiments.