The Design of Communication Process for the SPring-8 Linac Control System

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1. Introduction

The SPring-8 Linac consists of many accelerator components.They are distributed along the Linac. They will be controlled from remote control center.

FIG.1 shows overview of the Linac control system. Each accelerator component is connected to a controller and controllers are connected to WS(workstation)'s at control center via Ethernet. There are ~300 accelerator components to be controlled, 22 VME computers as distributed controller and some WS's as operator interface.

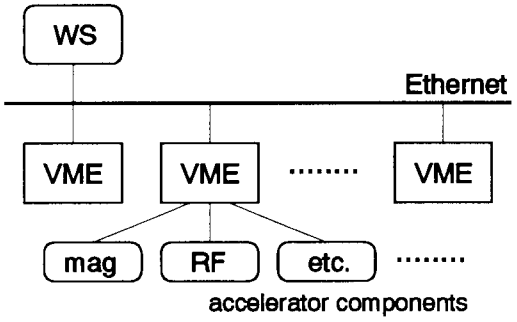

FIG.1 Overview of the Linac control system

An advance in our design is that accelerator components are modeled as objects. The object is combination of an accelerator component and a control process. Objects can be dinamically linked to build various control functions matched to operation purpose flexibly.

2. The SCD Protocol

In such an object oriented design, inter-object message communication is the key to build the system. We have designed a custom inter-object protocol called SCC (SPring-8 Linac control commands) and an inter-computer protocol called SCD (SPring-8 Linac control datagram).

The SCD is based on UDP/IP connection-less data transmission. The reason to choose UDP instead of TCP are followings. A) There are many objects and many connections are required. This causes exhaustion of system resource or takes open/close overhead. B) The message is not in stream style. We assume that most of control messages will be small size packet and TCP will be expensive for the system.

However UDP is too simple, the SCD supplements following features. A) The SCD empolyes reliable data transmission scheme. The ACK-timeout sequence offers reliability. B) The SCD supports object addressing. The SCD address system can distinguish all of objects that is needed for message delivery. C) The SCD can resolve object address. The MAR(machine address resolution) procedure allows dynamic (on demand) address resolution. No static address database is required. D) The SCD supports large size data block transmission. Data block will be fragmented into numbers of SCD packet and blocking/deblocking process will be done automatically.

3. The Communication Process

We have implemented the SCD protocol into communication processes for WS (HP-UX) and VME (OS-9). The communication process will be run on each computer and play a roll of postoffice in the system. The communication process receives a message on SCD through Ethernet, then deliver it to the addressed process. (FIG.2)

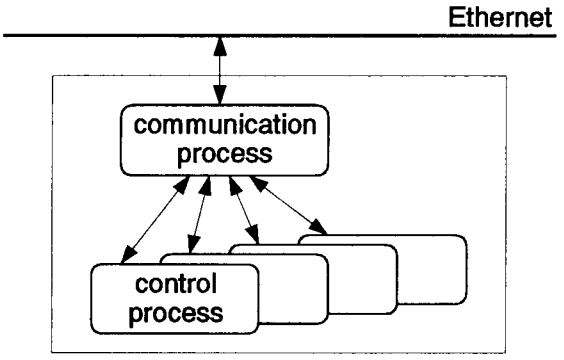

FIG.2 The communication process

An advantage of this scheme is that most of complexity about inter-computer communication is concentrated into the communication process. We can make control processes to be simple and light.

Finally, communication processes both for WS and VME have been tested. They worked well. We are now porting it into VMS.