Plan for
Network Based EPICS Drivers
of PLC's and Measurement Stations

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JHF Linac Control Group
Plan of Control System for JHF Linac

◆ Studied Control Systems at KEK and Chose EPICS

◆ During Study, Many Field Networks Found in KEK Homemade, Proprietary, etc.

◆ However at KEK e⁻ Linac, Many TCP/IP Connected Controllers (>150) No new Field Networks Recently
Network Connected Controllers

- Simplified Software, Management, Troubleshooting
  Efficient in Speed, Cost, Manageability
  Do not Consume Human Resource much

- Selection of Standard Network Device Technology
  Standard Software
  Flexible in Designing the Network
  Easily Understood (the Same Technology at Offices)

- Normally UDP/IP for Simplicity and Error Handling
  TCP/IP as well (cf. out-of-band TCP packets)
Programmable Logic Controller; PLC

- Modern PLC's are Powerful and Flexible
  Good Candidate for Remote I/O Controllers
- Not too Fast on the Network (5 to 30 millisecond Response)
  but Fast Enough for General Purposes
- Pre-processing of Control Variables
  Scientific Functions, Floating Point Calculations
- Chose Yokogawa's FA-M3 (Factory ACE)
  Maintenance Capability over Ethernet/TCPIP
  Not from other Vendors in Japan
- At JHF,
  Vacuum, Magnet, Ion Source
  and Microwave Equipment
Measurement Station

- Waveform Observation
  GPIB connected Oscilloscopes or VXI
- At JHF,
  Beam Pulse of Several Hundred Nanosecond
  Cost Performance
  Noises from Modulators
- Chose Yokogawa's WE7000 (as well as VXI)
- Network Specification was Disclosed
  Evaluating IP Communication Software on Unix
  (Originally Developed for Windows Environment)
GPIB, Serial and Others

- Major measurement Instrument
  Still GPIB or Serial (RS232C)
  Cannot Escape from them

- Gateway Boxes
  Employed also in EPICS Community
  Can Accomodate Distant Location
  Isolate Hardware Trouble Easily

- Many Vendors Began to sell
  Network connected devices
  Oscilloscopes, Video Frame Grabbers, etc
Configuration under EPICS

- Investigate a Proper Network Structure for EPICS and Network-based Controllers
- Communication between IOC's and OPI's through CA
- IOC's and Network Controllers for Polling
- Management Station and Network Controllers
EPICS Software

- IP Software is Available Standard on VxWorks
- Synchronous Access is Straightforward
- But Response Time of 5 - 30 Milliseconds
  EPICS do not Allow This
- Asynchronous Version should be Developed
- First, Test Implementation on Unix
  Then, to VxWorks
Software for PLC

- PLC Access Routine at e⁻ Linac was Generalized
  Tested on Unix
- Synchronous Version of EPICS Device Support
  Help Understanding this Architecture
- Testing Several Access Method
- On-demand (Interrupt) Protocol
  Host IP Address Have to be Hard-coded
- Block of PLC Memory as Shared Memory
  Between IOC and PLC
- Naming Scheme for OUT/INP
Software for WE7000
- Software is Evaluated and Investigated on Unix
- Status of a Station Have to be Managed on Host Implemented with Threads
- Port Software on to VxWork IOC Replacing POSIX Thread with VxWorks Tasks
- Waveform Record will be Implemented First
Conclusion

◆ IP Network Based Controllers
  Such as PLC or WE7000
  Simplify Designing Control System
  (While Keep Studying Other Field Networks)

◆ Software is under Implementation
  Straightforward and Will be Realized soon

◆ More Investigation on Naming Scheme
  Specification of Variables

◆ Hardware/Software will be Installed
  From the Beginning of the Next Year