Non-vxWorks IOCs at KEK

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Overview

- A variety of non-VxWorks IOCs have been used in KEK
  - Location : Linac, KEKB, J-Parc, PF
  - CPU : Intel x86, PPC, SH4, …
  - Formfactor : VME, PC, Scope, Embedded, …
  - OS: Linux, RTEMS, uITRON, Windows, ….
- Today, I'm going to report some of them.

List of Developments at KEK

- not a full list
- There are no “standard hardware” in KEK

Name	Shape	CPU	OS	location	developper
Suzaku	Board	FPGA,PPC	Debian Linux	J-Parc	A. Akiyama
	Oscilloscope	Intel x86	Windows	Linac, PF	M. Satoh, J.Wang, T. Obina
MCU	Box	SH4	u-ITRON	KEKB	G. Jiang, J. Odagiri
	VME	PPC	RTEMS	Linac	K. Furukawa, M. Satoh
	VME	Intel x86	Linux	PF, J-Parc	T. Obina, G. Sheng, N. Kamikubota
FIT	Box	Intel x86	Linux	PF	T. Obina, M. Tadano
ICOP	19' 1U rack	Intel x86	RTEMS	KEKB	A. Akiyama
CC-Net	CAMAC		Linux	KEK	J. Odagiri, M. Komiyama, S. Araki

Network-Attached Device

- socket communication
- Linux (or other OS) EPICS host
- ASYN or netDev are often used
- I don't mention these device today.

Many number of devices.....for example.....

PLC(Yokogawa, Omron, Melsec, etc) : netDev by Odagiri-san
Chino Data Logger
Yokogawa MW100
Oscilloscope(Tektronix, Agilent, etc) : VXI-11 or Socket
XPort (RS232C - Ethernet Converter) : Socket
Keithley 2701 DMM : ASYN +Socket

2. Example

2-1 Suzaku

contact : A. Akiyama (KEK)

2-2 Windows oscilloscope

contact : M. Satoh (KEK), J. Wang(USTC)

2-3 F&eIT

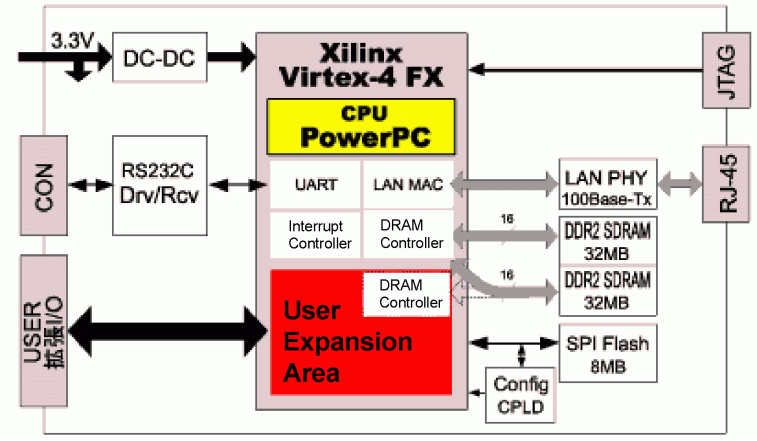
contact : T. Obina, M. Tadano (KEK)

2-1. Suzaku(朱雀)

- http://suzaku.atmark-techno.com/
- SUZAKU-V
  - Virtex-4 FX (XC4VFX12-SF363)
  - PowerPC 405 (350MHz)
  - Memory
    - DRAM 64MB
    - FLASH 8MB
  - OS : Linux(Kernel2.6)
  - Number of I/O pin : 86
  - LAN Interface (10/100M)

Suzaku

- size, configuration



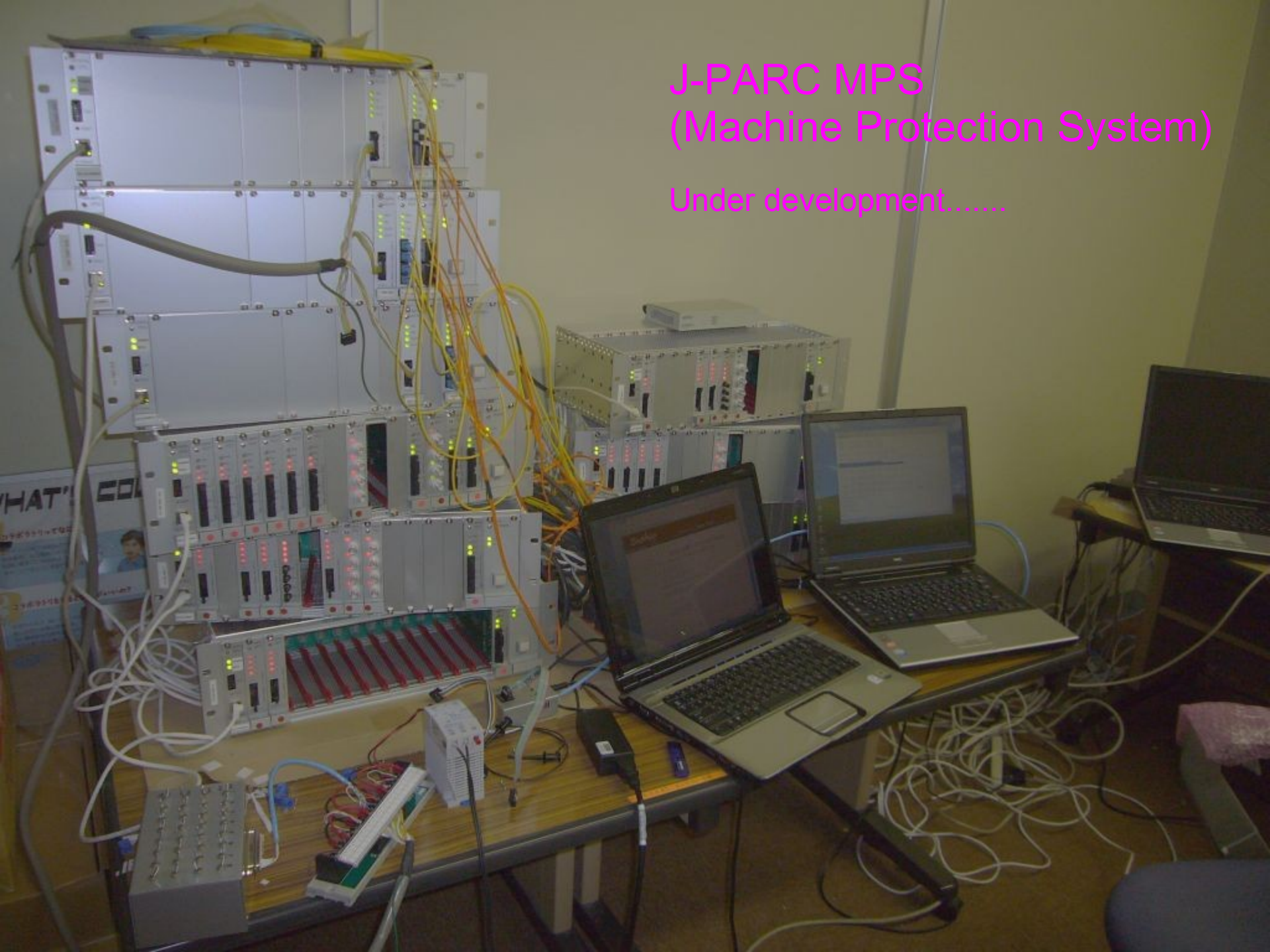
Development Environment

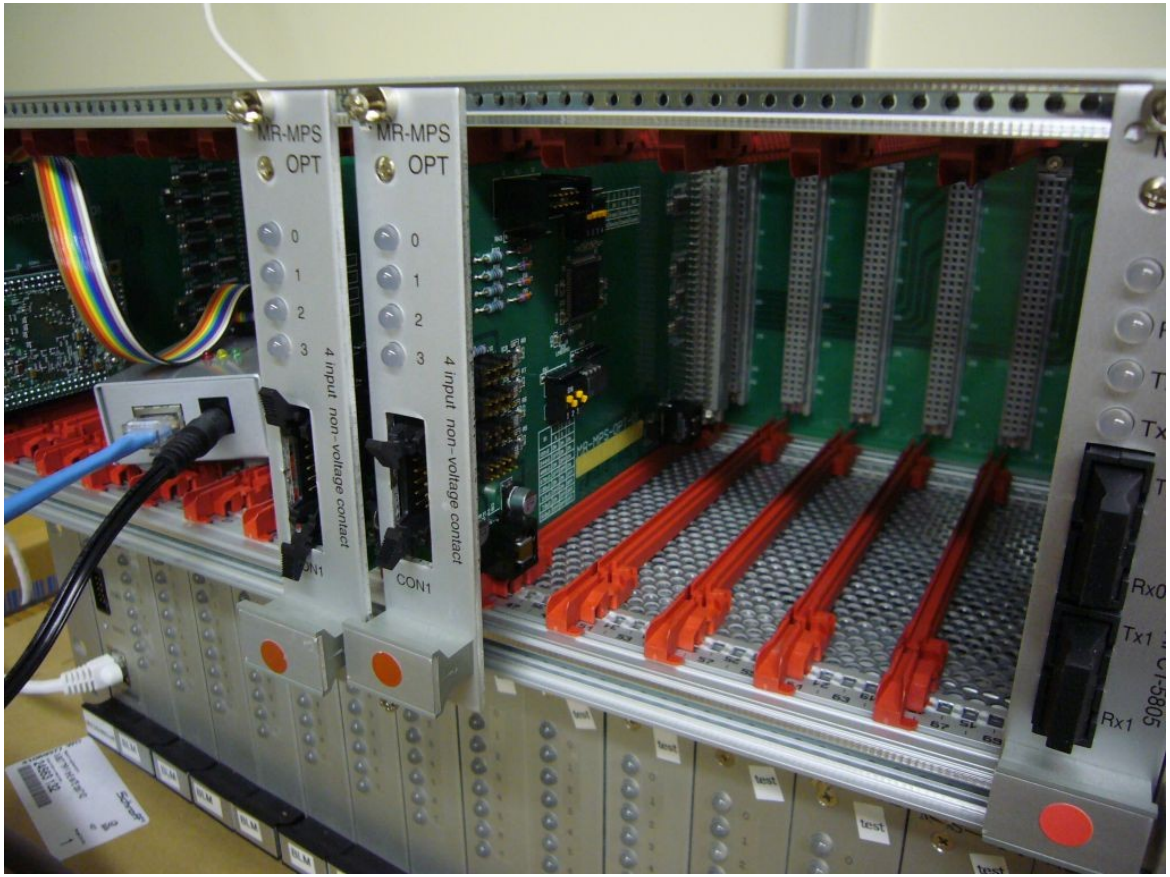
- Price :
  - ¥44,100(JPY) = $420USD = ¥3,000RMB
- FPGA Development:
  - Xilinx ISE and Xilinx EDK
- Software Development:
  - Atmark Techno Development Environment
    - Supplied as VMWare Virtual machine image
    - Linux desktop and GNU cross development environment
    - No need to setup development machine.
    - Only “VMware Player” is required
  - or … Create your own environment

Applications for J-Parc

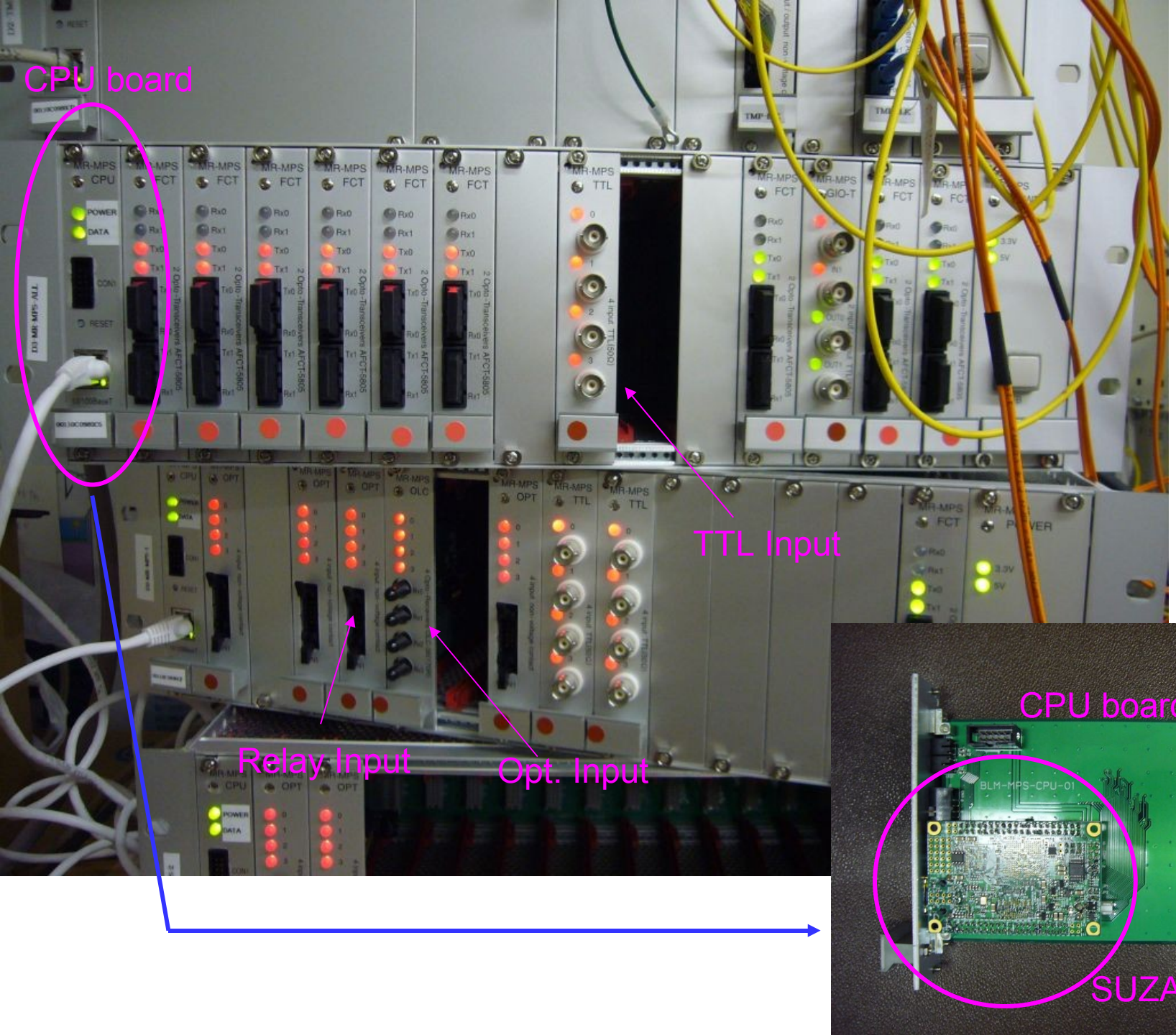
- Developer : Akiyama-san (KEKB,J-Parc)
  - Please ask him for detail !
- Old version of SUZAKU is not recommended ….. difficult to install EPICS (libc)

- Applications for J-Parc
  - Machine Protection System (MPS)
  - Beam Loss Monitor
  - Interlock of vacuum pump


J-PARC MPS
(Machine Protection System)
Under development.....



backplane
several kind of input board
relay input, optical input, TTL input
each board equip CPLD for logic control


CPU board
TTL Input
Relay Input
Opt. Input
CPU board
SUZAKU

note

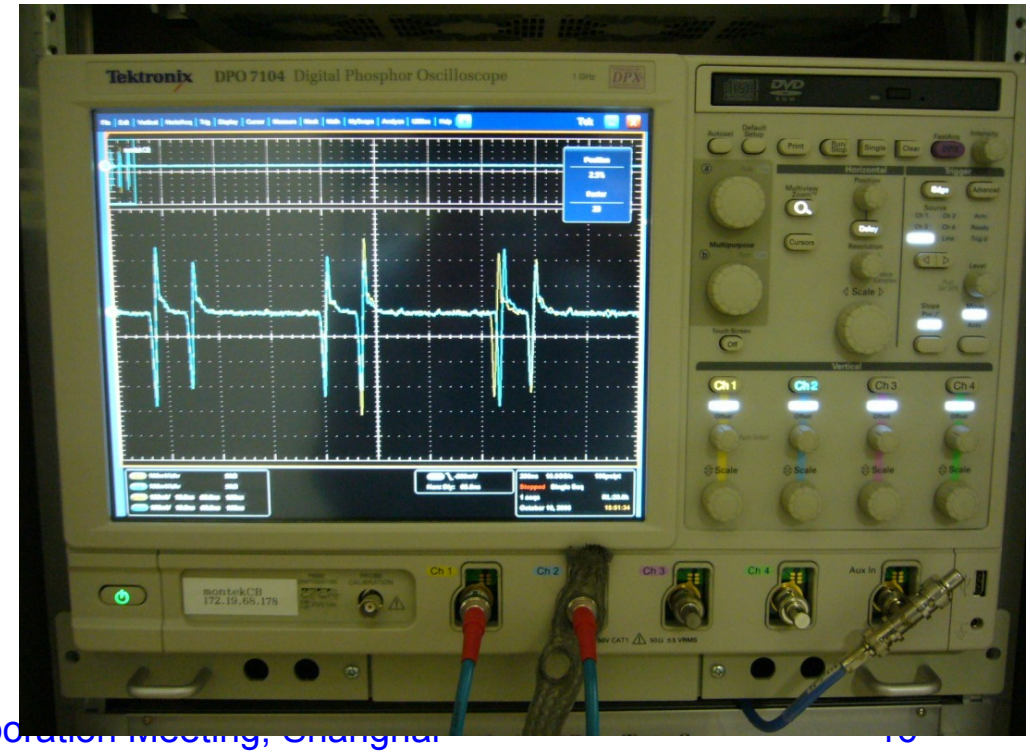
- 8MB Flash is not enough to store EPICS
- use NFS to download EPICS or other image
  - only at boot time
  - copy to DRAM (64MB) area during boot

2-2. Windows Oscilloscope

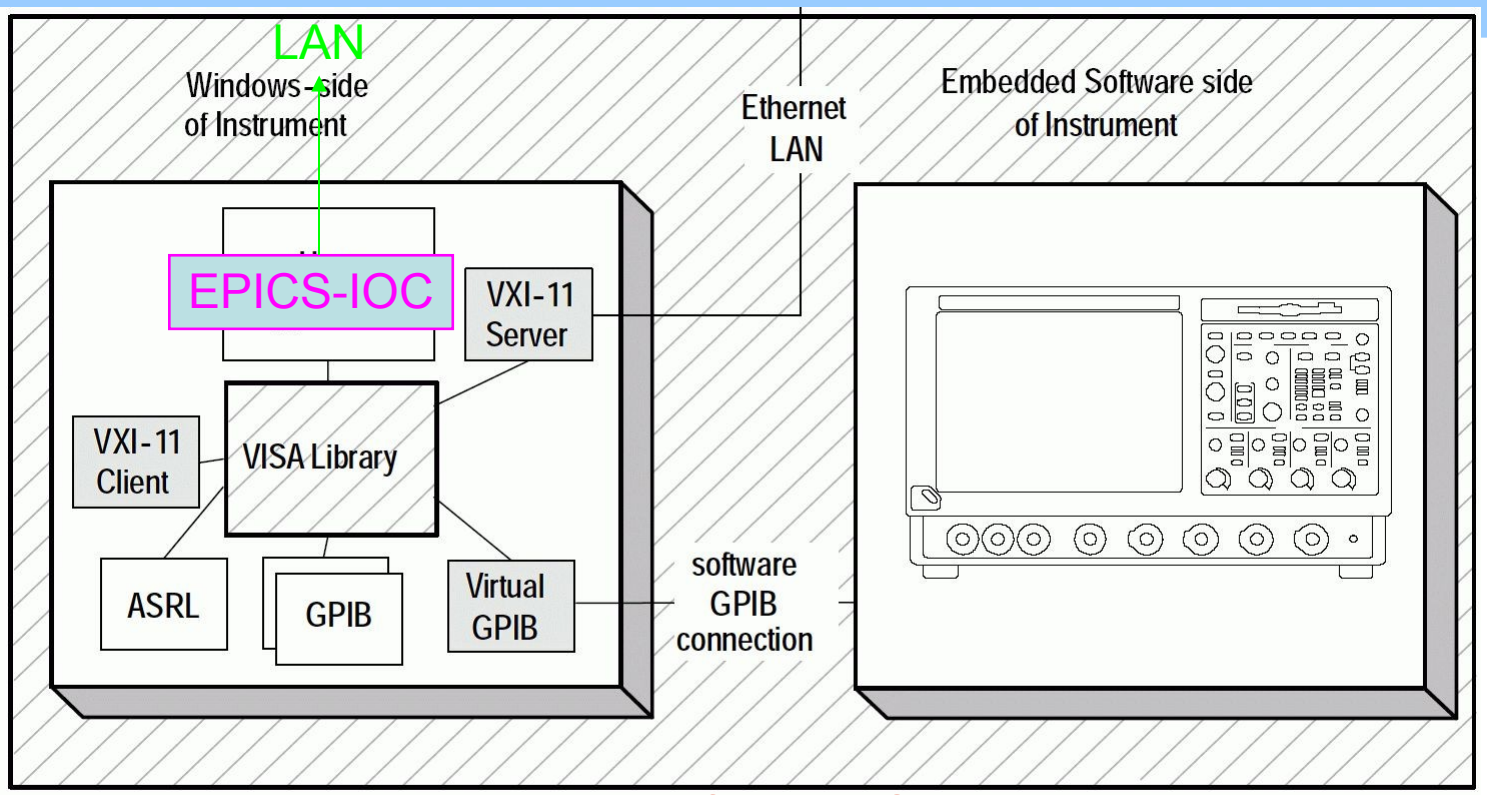
- Linac BPM, PF-BT BPM, etc
  - M. Satoh, J. Wang (USTC)
- Target:
  - 50Hz data acquisition rate for 4ch waveform

Tektronix DPO7104

- 10-GSa/s (4ch), 8-bits
- 1GHz Analog Bandwidth
- Windows XP based (P4 3.4-GHz)
- Gigabit-Ethernet
- Total Number : 24



Software



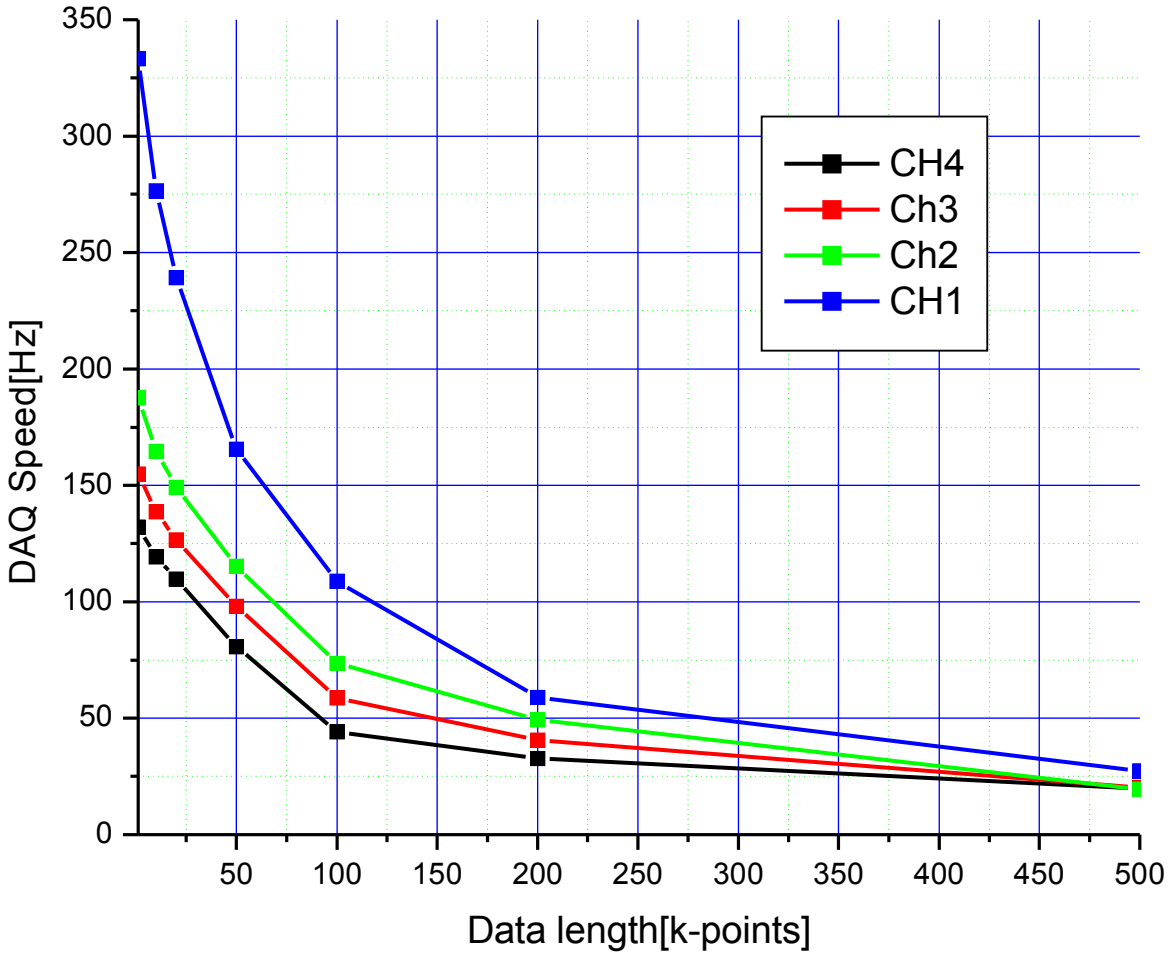
ref : TekVISA programming manual(ver 1.1, p24)

Figure 1-2: TekVISA Supports Local and Remote Connectivity

- Device Support : IVI-Com or TekVISA
  - Finally TekVISA is adopted

Performance

- Speed vs Data Length 1k – 500k



Device Type

- New device type
  - Waveform : devWfTekDPO
  - subArray : devSATekDPO
    - calculation of X, Y, Sum, Vx1,Vx2,Vy1,Vy2

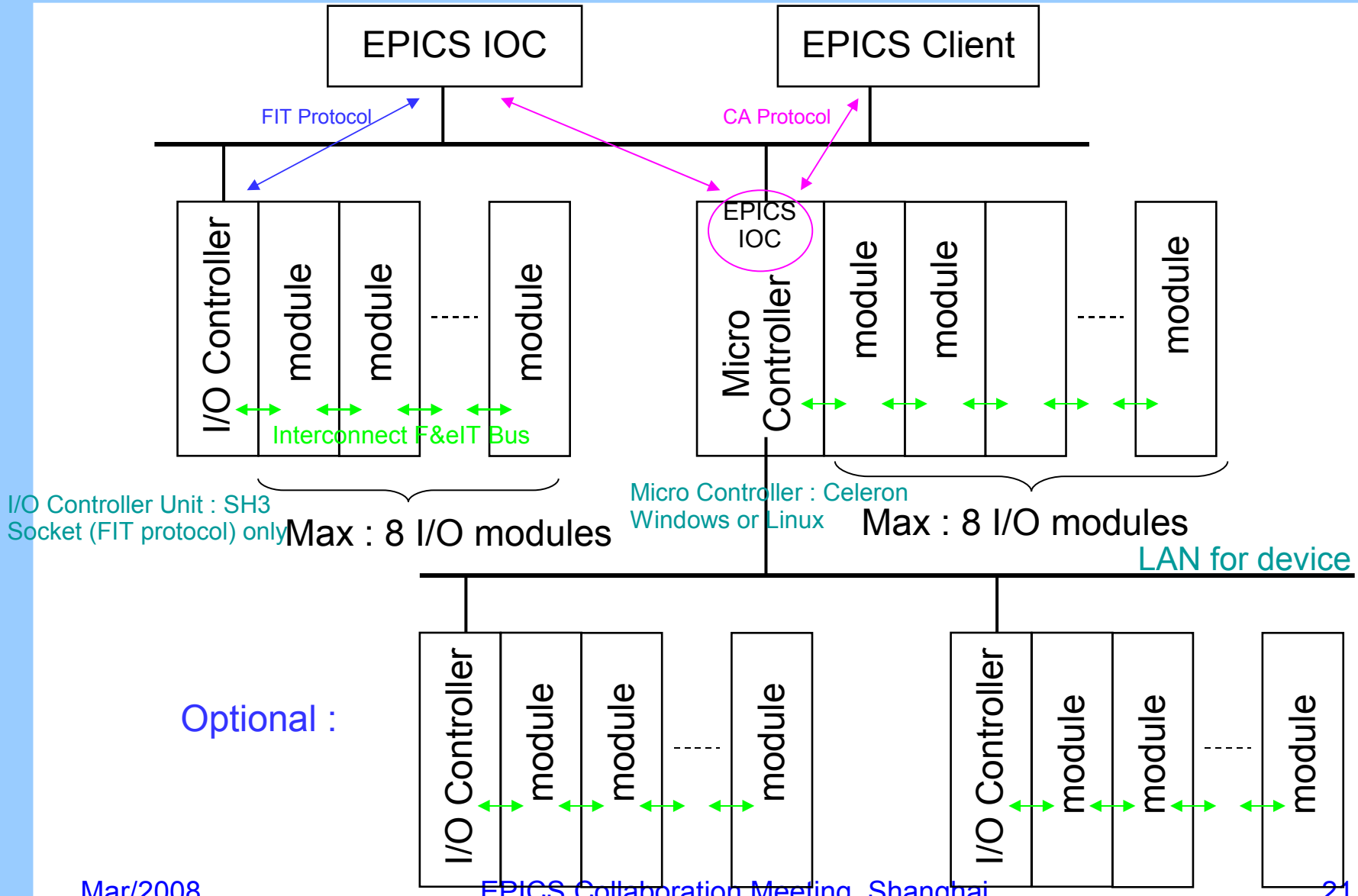
2-3. Contec F&eIT

pronounciation : fi't

- http://www.contec.co.jp/fit
- for distributed monitoring and control
  - Controller
    - Micro-controller : OS (Windows or Linux)
    - I/O controller : Ethernet only(embedded controller)
  - I/O Module (same module for both controller)

- General purpose I/O software for linux is available with source code!
- Open Architecture
- 35mm DIN rail mount system
- Inexpensive

Hardware setup example



Controller

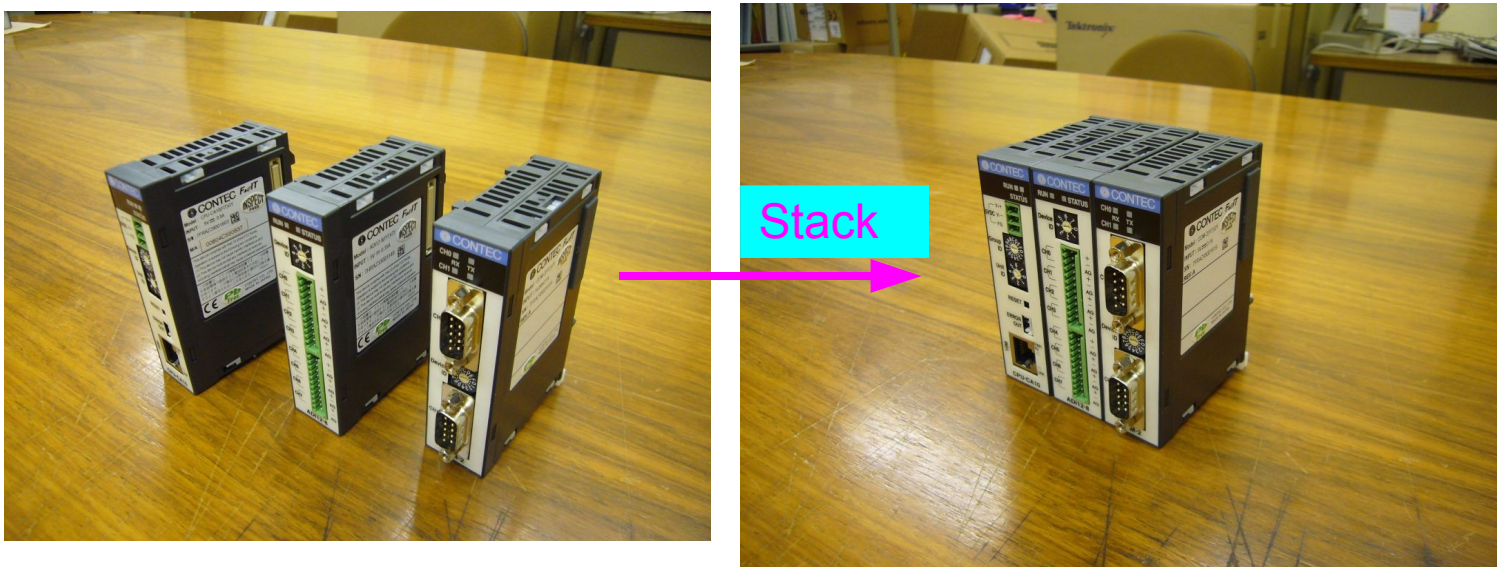
- Micro-Controller Unit
  - Two series ….. but SB20 will be discontinued soon
    - CPU-SB20 (AMD Geode SC2200 266MHz)
    - CPU-SB30 (Intel CeleronM 800MHz)
  - Compact Flash (or Microdrive) for OS
  - Spec is same as a PC(Display,Sound,Ethernet,etc)
  - without any kind of fan
  - ¥165,900JPY=$1,600USD=11,300RMB
- I/O Controller Unit
  - CPU: CA-20 (SH-4 240MHz), Embedded OS
  - Socket program for communication (F&eIT protocol)
  - ¥37,800JPY = $360USD =¥ 2,600RMB

I/O Modules

- Many kind of I/O Modules
  - Analog I/O, Digital I/O, RTD, Reed Relay, etc
- No backplane (Module Stack), 35mmDIN rail

- ¥20,000 - ¥50,000JPY
  = $190 - $480USD
  = 1,400 - 3,500RMB


Interconnect Bus


Stack

Applications at PF

Controller of Screen Monitor
Monitor of temperature, voltage, etc

size of new SB-30 CPU modules became Big!
Geode -> Celeron

EPICS Device Support

- For Micro-Controller
  - Linux self-compile environment (linux-x86 target)
  - EPICS device support has been developed
    - software development is easy (VME_IO)
    - In operation .... but not all modules are supported
    - Need more time to support every I/O modules
- For I/O Controller
  - Not yet
  - Use Asyn or netDev?
  - Simple C Program + caput is used for test.

4. Latest News!

- Yokogawa will release new machine controller product in near future
- Model Number : e-RT3 2.0
- Linux OS will be installed
- EPICS ready?
  - Odagiri-san (KEK) and Uchiyama-san (SHI) will develop device support for e-RT3

e-RT3
eMbedded M@chine Controller

VxWorks iTRON

OS-9 WindowsCE

e-RT3 2.0
+ Linux, EPICS