Controls Activities at KEK
Issues for ILC

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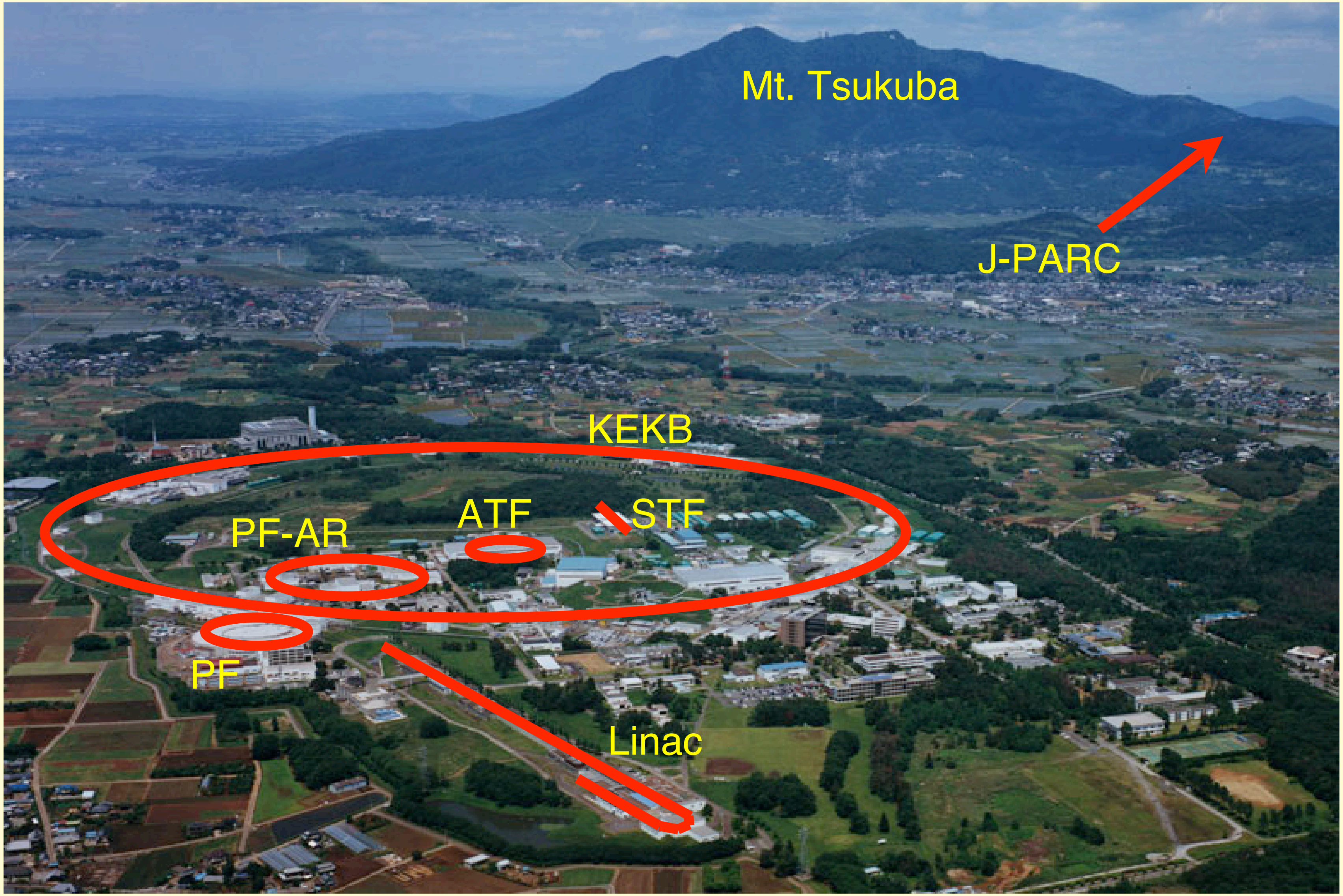
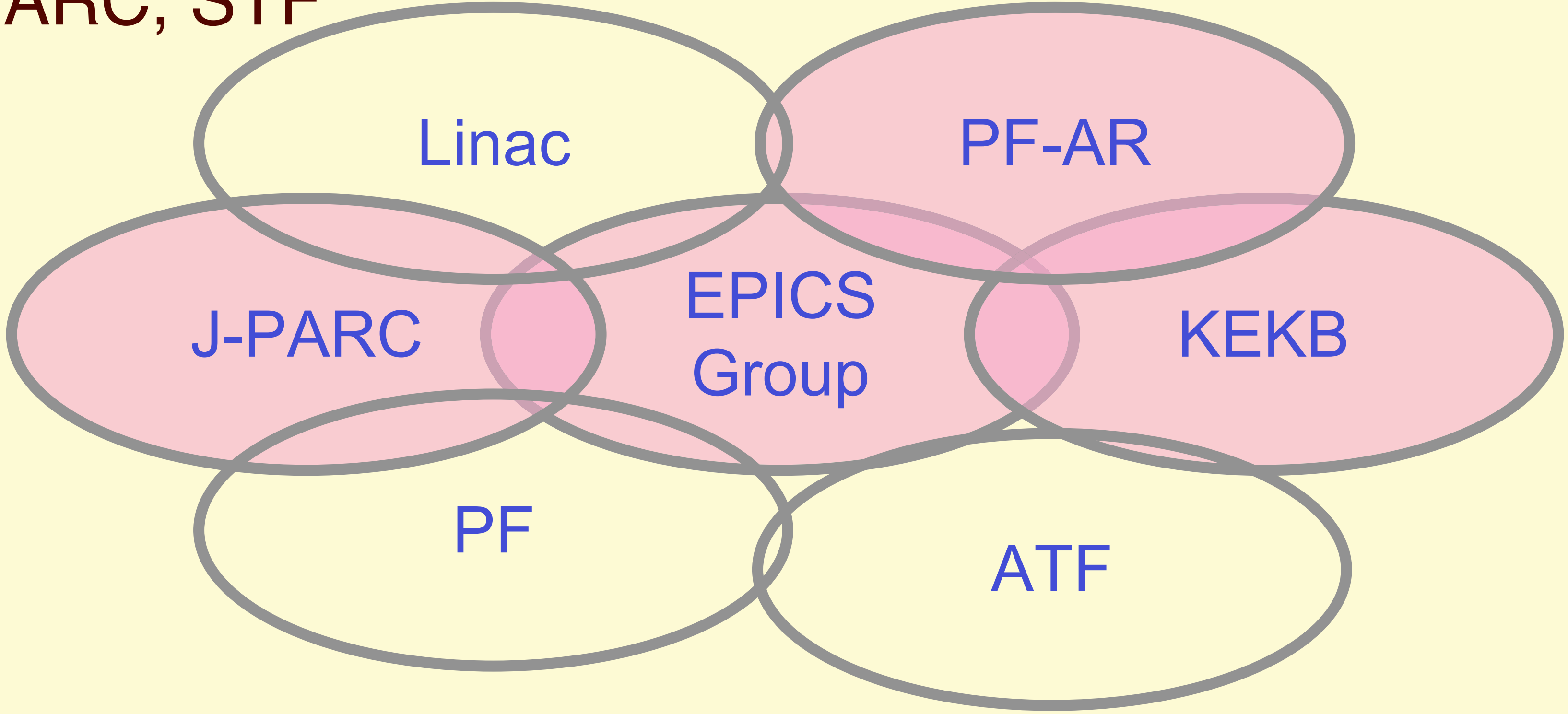
Accelerators at KEK



Activities for Existent Accelerators

- Operational Presently
  - Linac, PF, PF-AR, ATF, KEKB
- Under Construction
  - J-PARC, STF



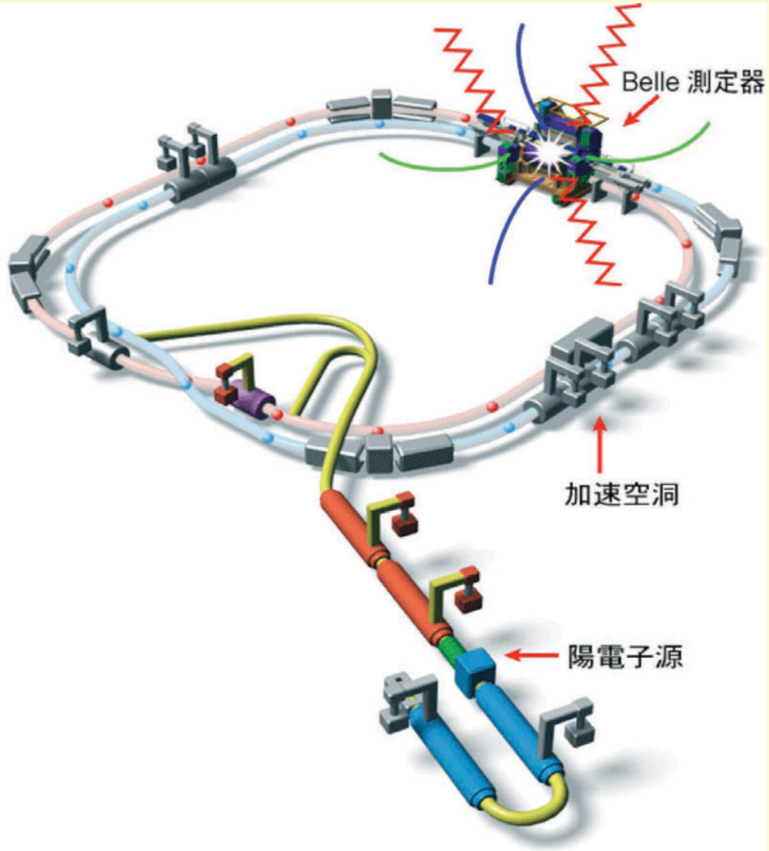
Operational Accelerators (1)

- Some Variety of Control Hardware/Software
- e^-/e^+Linac
  - 1982~ 2.5GeV, 1998~, 8GeV e-, 3.5GeV e+, 50Hz, 0.1 -10nC
  - Control System was Replaced in 1993
    - Home-grown RPC over UDP and TCP
    - Distributed Shared-memory
    - Hash-based Static Database
    - VME, VXI, PLC, Almost-Ethernet-only
    - Redundant Network System
    - GUI with Tcl/Tk, SAD/Tk, Python/Tk, VB
    - Home-grown Archiver, EPICS Archiver
    - Many gateways to/from EPICS, Windows OLE/COM, Other facilities, etc
    - Operational Log on Windows SQL - VB

Operational Accelerators (2)

KEKB

- 1999-, Asymmetric Collider B-factory
  - CP-Violation Study, Possibile SUSY Signal?
  - Daily Mutual Improvements with PEP-II
- Control System:
  EPICS from the beginning
  - PPC-VME/VXI (x100), ArcNet (node x2000), CAMAC, GPIB, PLC, etc.
  - GUI with SAD/Tk, Python/Tk, Medm.
  - Partially Oracle, Postgres.
  - EPICS kblog Archiver
  - Operational Log with Postgres - Zope
  - Home-grown Single Alarm Handler

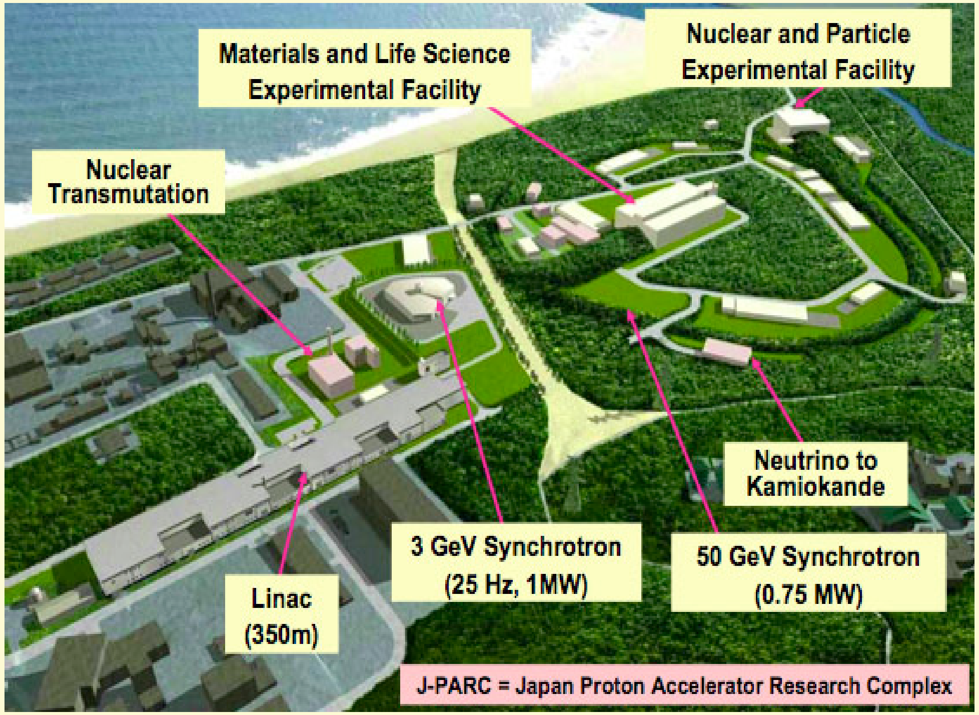


Operational Accelerators (3)

- PF
  - 1982~, 2.5GeV Light Source
  - Home Grown Control System
  - Gradually Integrating EPICS
- PF-AR
  - 1986~: 8GeV Accumulator, 1999~: 6.5GeV Light Source
  - EPICS since 1999
  - Shared resources with KEKB
- ATF
  - Accelerator: 1992-, Linac and Damping Ring
  - V-System, Linux-socket-based,
  - CAMAC, etc.
  - Java
  - One EPICS System for S-band rf-Gun

J-PARC

- 400MeV Linac, 3GeV RCS, 50GeV MR
  - Very High Intensity (1MW) and Multi Purpose (Materials, Nuclear, Particle,etc)
    - Machine itself and MPS Difficult
  - Control System
    - EPICS after success at KEKB
    - Ethernet-only after success at Linac
    - VME, PPC-VxWorks
    - PLC, Ethernet-base Controllers
    - Redundant Network System
    - Online Relational Database
    - XAL / Java, SADscript on Java
    - SAD/Tk, Python/Tk
    - Channel Archiver


Materials and Life Science Experimental Facility
Nuclear and Particle Experimental Facility
Nuclear Transmutation
Neutrino to Kamiokande
3 GeV Synchrotron (25 Hz, 1MW)
50 GeV Synchrotron (0.75 MW)
Linac (350m)
J-PARC = Japan Proton Accelerator Research Complex

EPICS and SAD at KEK

- EPICS: Shared bus for control systems after KEKB
  - For the lower level EPICS provide most functionalities and a good compromise for speed, simplicity, etc.
  - For the higher level we may need more structural functionalities and information hiding, etc.
- SAD: Accelerator design and operation environment
  - SAD provides many accelerator designing functionalities and
    - GUI with plotting
    - EPICS Channel Access
    - Scripting with Mathematica-like Language
    - Database Access
    - Numerical Manipulations like Modeling (Fitting), etc.
- Indispensable for KEK accelerators

ILC Controls Considerations

- Lifespan of the control system: Long term project
  - Variety of Control Systems at KEK
    - Because Accelerator Controls have to follow Technologies at the time, anyway, for several reasons.
  - At Most 10 Years?
  - Have to Design Ever-changing Control System for ILC?
- Reliability of the machine: Large scale
  - Can Human handle this?
  - Redundant technologies
  - Testing before/during operations

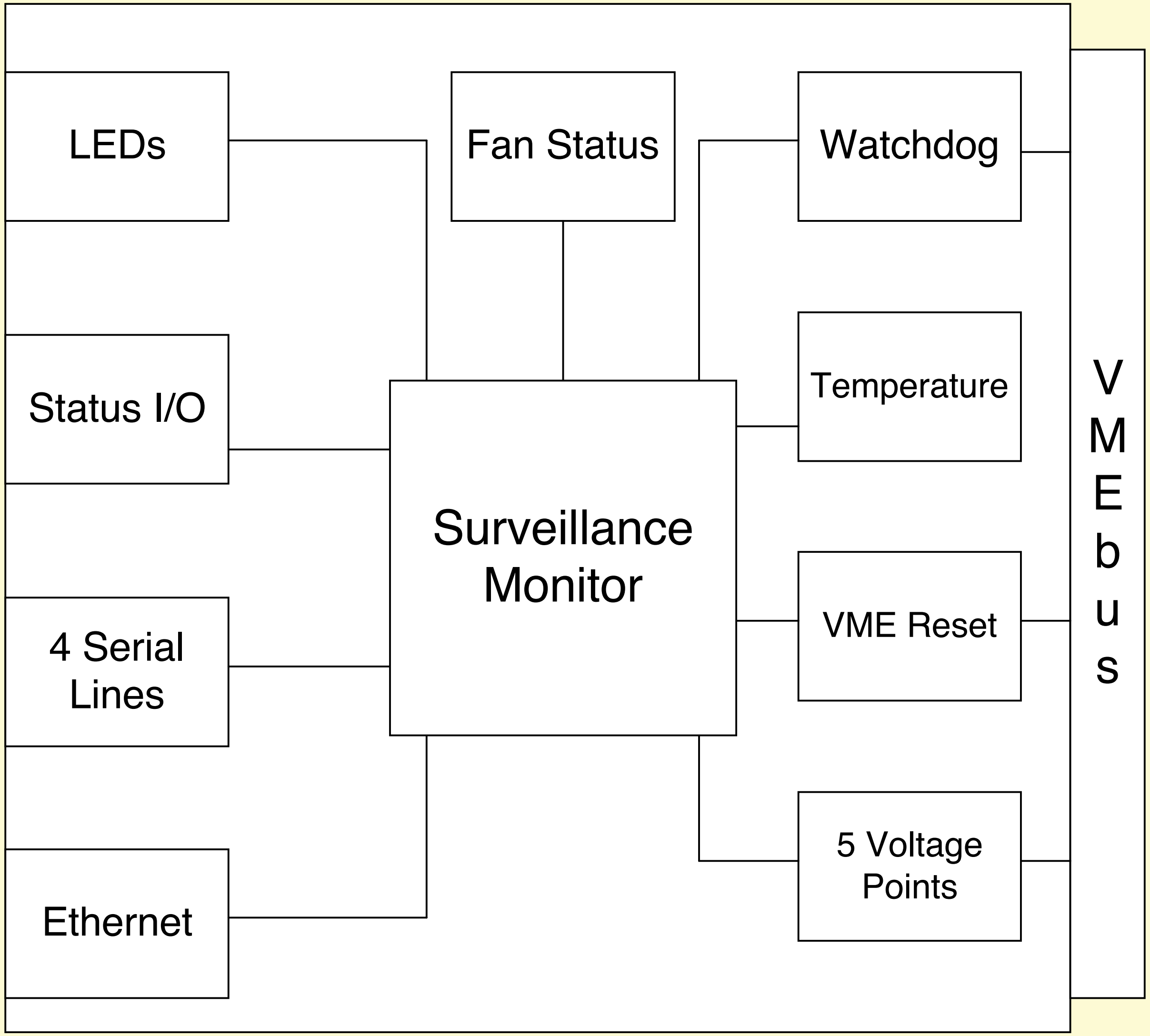
Redundant Technologies

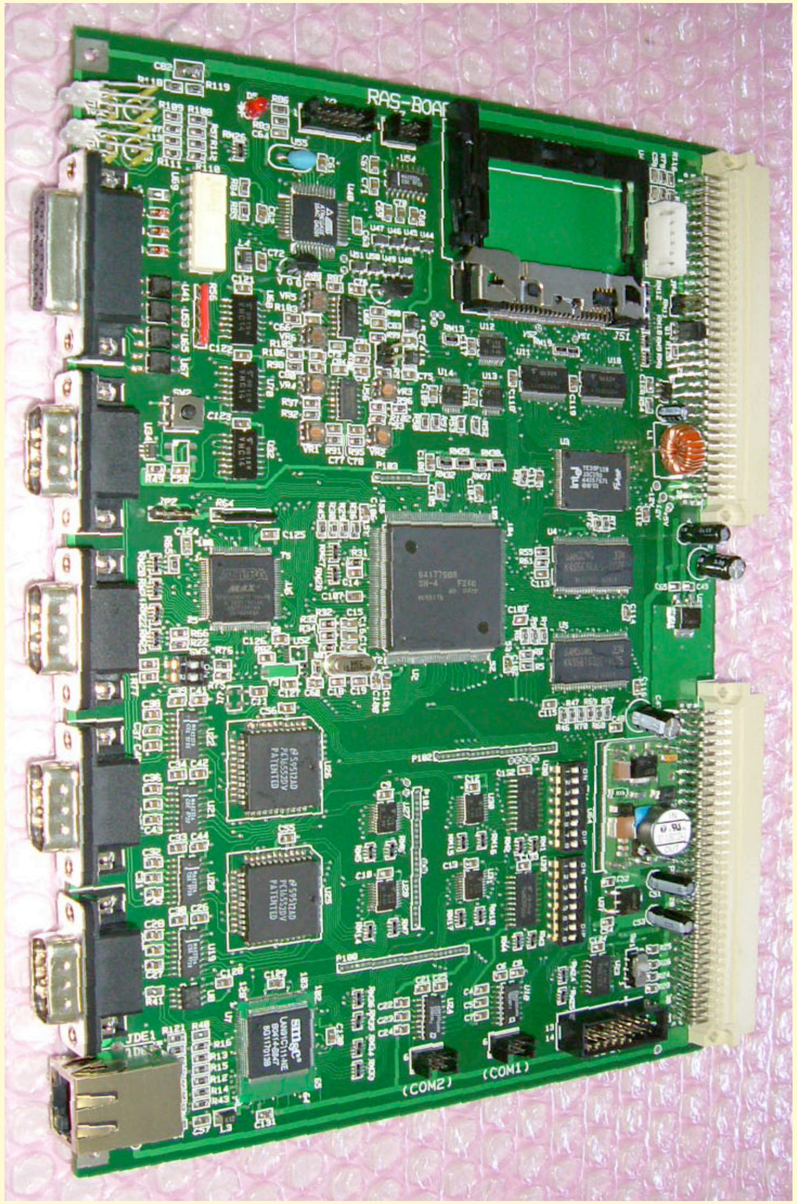
- In order to shorten the down time
- Existent redundant facilities
  - RAID
  - Redundant Network Routers (HSRP,ESRP,Spanning Tree)
  - Power-supplies
  - File Servers (Life-keeper, Rose-HA, freeware for Linux and/or BSD)
  - etc.
- If commercially available technology exist, we should consider

Testing

- Many functionalities in base software
  - Unit-test should be developed
  - Ex. EPICS and SAD are now ported onto several different platforms, because of embedded controllers and faster machines.
- Complicated application software
  - Regression-test should be applied
- Complicated Hardware configurations
  - Dedicated test software should be written
- More dedicated monitoring is necessary at runtime
  - Ex. RAS/VME board, etc.

RAS/VME


LEDs
Status I/O
4 Serial Lines
Ethernet
Fan Status
Surveillance Monitor
Watchdog
Temperature
VME Reset
5 Voltage Points
VMEbus


RAS-BOAR
(COM2)
(COM1)

- Thank you …