Development of COM Express VME carrier board with remote management capability

JASRI/SPring-8
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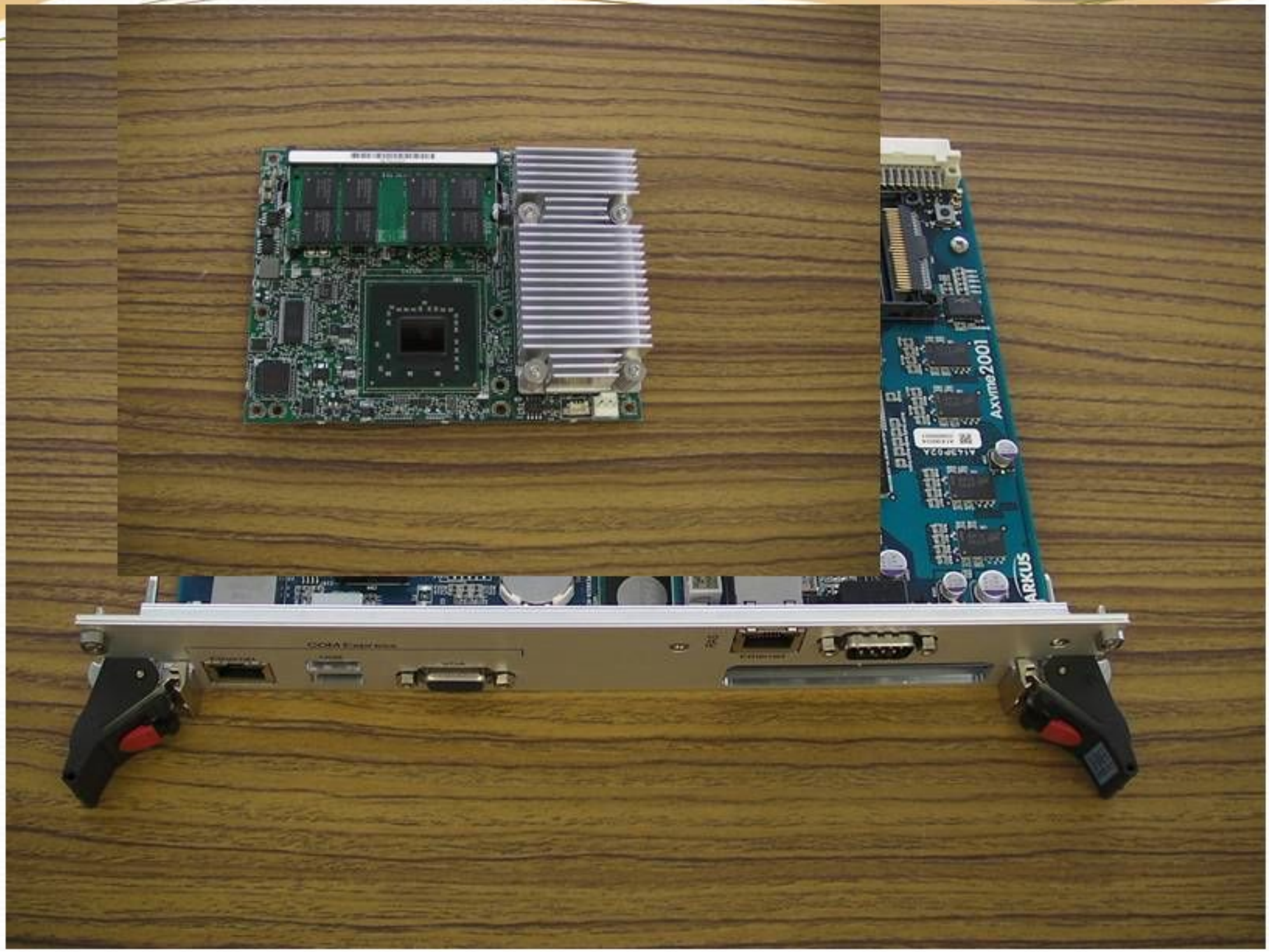
Axvme2001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outline

- Background of this development
- What is COM Express?
- Design of the COM Express VME carrier board
  - COM Express VME carrier board
  - Remote management capability with a daughter card
  - VMEbus remote control capability without COM Express module
- Future applications
- Summary

Background of this development

- Main reason is "gradually shrinking VMEbus market".
  - We faced difficulty of having a narrow choice of VME boards in the market although many new CPUs are introduced to CPU market.
    - It takes long time to develop a new CPU VME boards.
- The SPring-8 control system has over 200 of VMEs.
  - In addition, ~100 VMEs will be deployed in the XFEL now constructed in the SPring-8 site.
  - Not practical for us to discontinue VMEs.
- How should we solve the difficulty?

  ⇒ We have paid attention to "COM Express".

What is "COM Express"?

- The PCI Industrial Computer Manufacturers Group (PICMG) standardized "COM"

COM Express

COM = "Computer-on-Module"

- A complete computer built on a compact single circuit board with core CPU, memory, I/O controllers etc, but usually lacks the standard I/O peripheral connectors.
- Usually needs to be mounted on "a carrier board" with the standard peripheral connectors.
- It can be used in a design application like an integrated circuit component.

What is "COM Express"? –cont'

- Two types of form-factor
  - Basic

125mm

95mm

  - Extended

155mm

110mm

- Five types of pin-out of I/F connector(s)

Type	Connector rows	PCI Express lanes	PCI bus	IDE	LAN port
1	A/B	≤6	No	No	1
2	A/B+C/D	≤22	Yes	Yes	1
3	A/B+C/D	≤22	Yes	No	≤3
4	A/B+C/D	≤32	No	Yes	1
5	A/B+C/D	≤32	No	No	≤3

Only type-1 has compatibility with the other types of pin-out.

Design of the COM Express VME carrier board

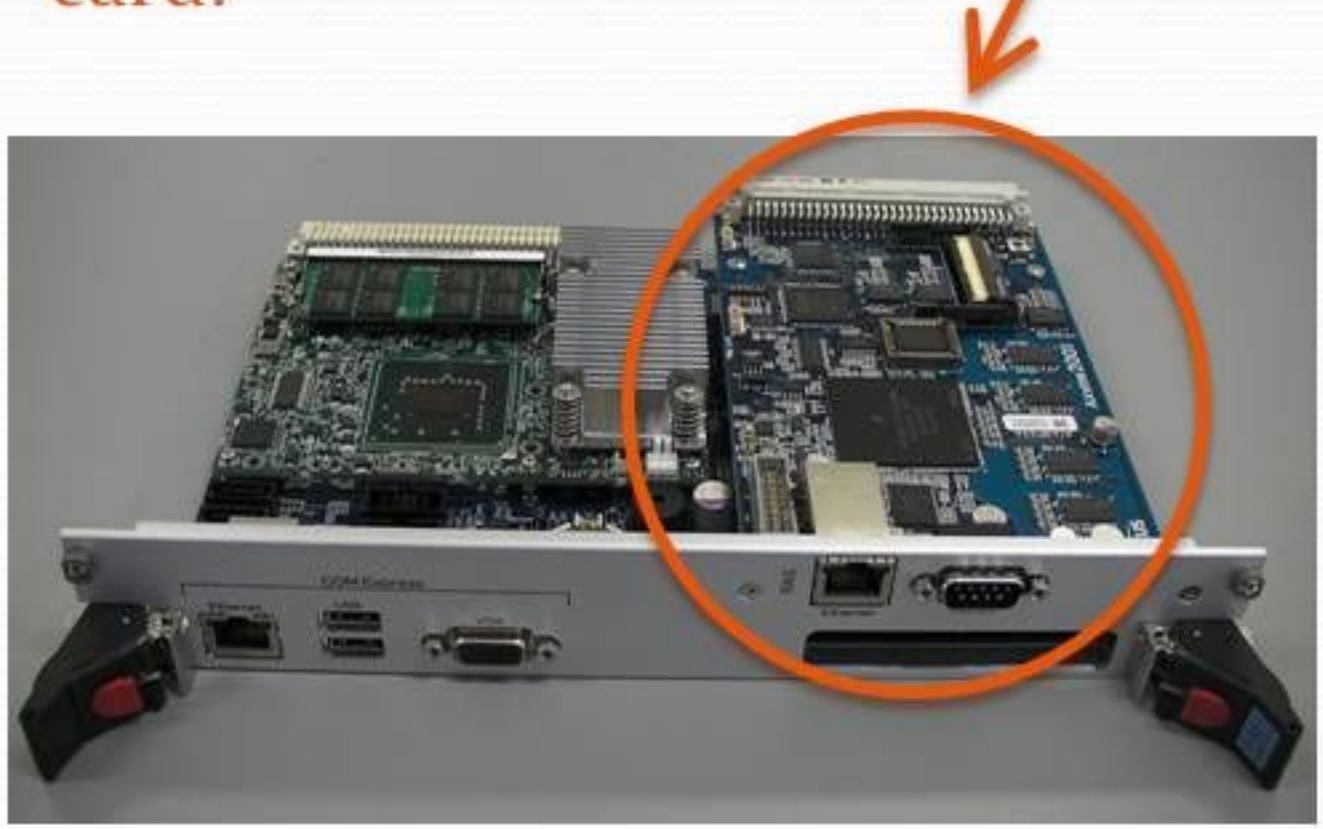
- It works as a VME CPU board with an attachment of a COM Express module.
- Advantages of this approach
  - We can select a suitable CPU module in the large COM Express market.
  - We can test and utilize the newest CPU in the VME computer soon.
- We designed and developed our COM Express VME carrier board to have following three functions;
  - COM Express VME carrier board
  - Remote management capability with a daughter card
  - Remote control capability of VMEbus without COM Express module

COM Express VME carrier board

- We limited our choice of the modules with the basic form-factor because we required a PMC/XMC site.
  - The extended form-factor is incompatible with a PMC/XMC slot on the 6U VME board.
- We designed the carrier board to have type-1 pin-out due to COM Express compatibility.
  - We don't use the specific functions assigned in the other types of pin-out. *(PCI, IDE, additional LAN,...)*
- We designed the carrier board supplying ~ 60W to the COM Express module.
  - Only +5V of VME bus is used for making +12V for the module.

Remote management capability

- Designed the carrier board to provide remote management functions by stacking a daughter card.



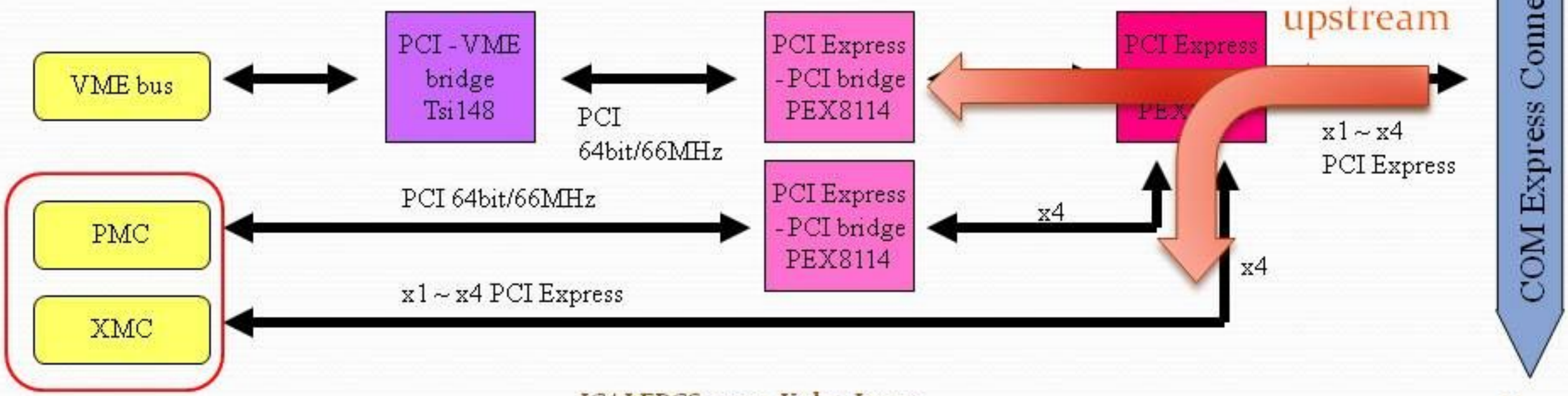
- Available management functions
  - Meas. of VMEbus +5V/±12V
  - Mon. of VMEbus interrupt line status
  - Meas. of temperature on the board
  - Meas. of temperature and drive voltage of the COM Express CPU
  - Reset the COM Express CPU
  - KVM-over-IP function
    - We can mon./cntrl. even boot-up screen of COM Express module.

Remote Management capability - cont'

- The daughter card has its own CPU (PowerQUICC), OS (Linux) and network I/F independently from the COM Express module.
- We can manage the VME CPU board using any Web clients on the same network.
  - Web server for the management functions runs on the daughter card.

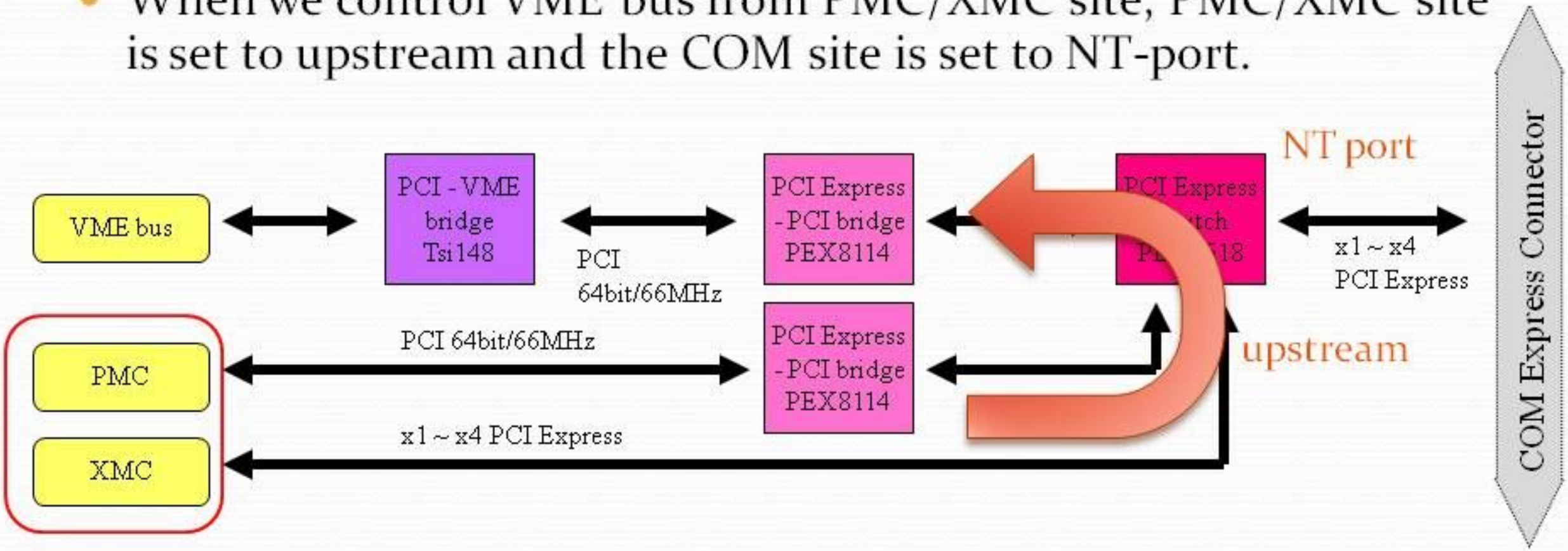
Remote control capability of VME bus without COM Express module

- We designed the carrier board providing remote control function through the PMC/XMC site without attaching COM Express module.
- In usual case, the COM Express module controls VME bus and PMC/XMC site



Remote control capability of VME bus without COM Express module –Cont'

- To realize remote control function, the key device is "PCI Express switch"
  - Using "non-transparent (NT) bridging" & "flexible port configuration" functions.
- When we control VME bus from PMC/XMC site, PMC/XMC site is set to upstream and the COM site is set to NT-port.



Future applications

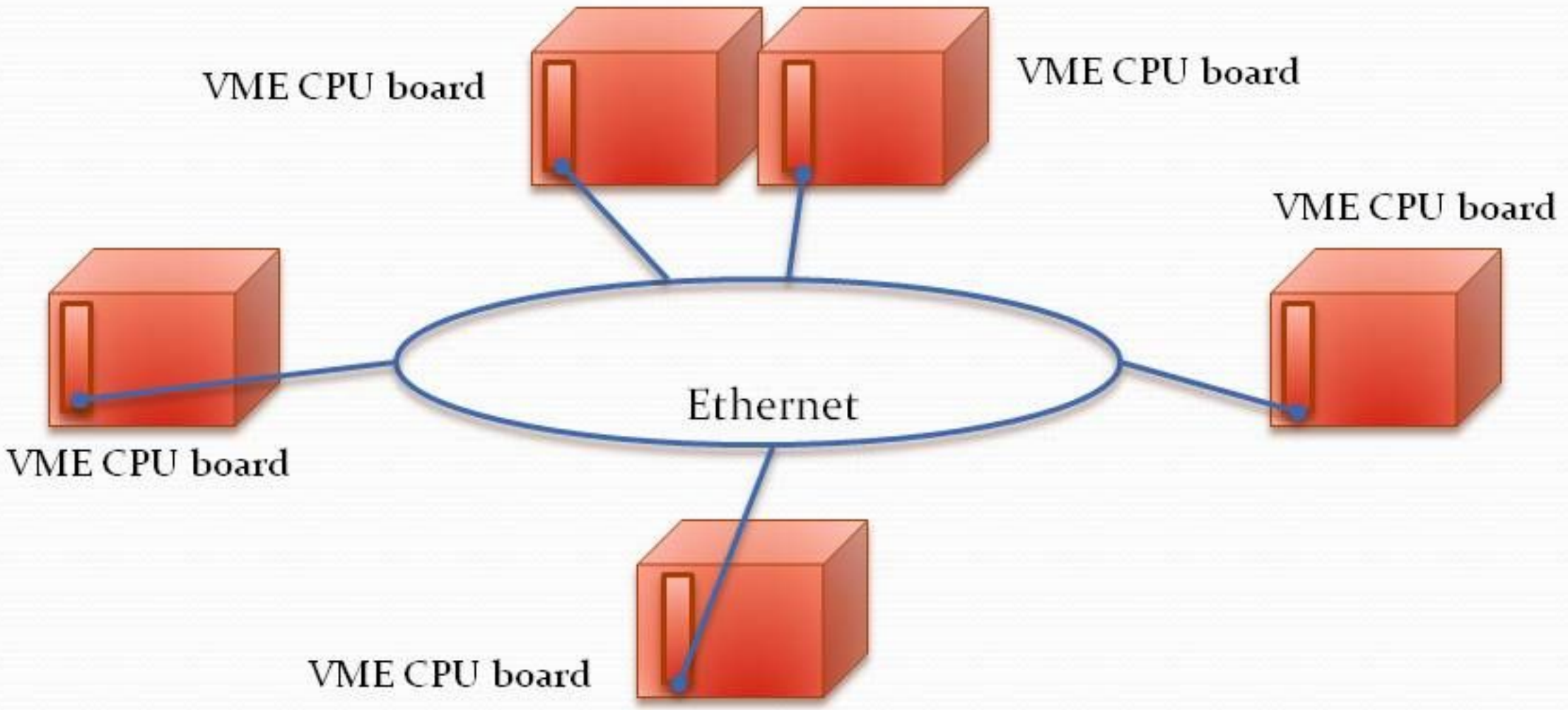
- We plan to replace the old VME CPU boards in the SPring-8 control system with the carrier board with a suitable COM Express module.
- We will utilize the management daughter card to monitor and record the VMEs status into database.
- That will facilitate our maintenance works and enhance the system reliability.

Future applications –cont'

- We will study the remote control of the VME crates from a remote high-reliable server computer.
  - We will be able to enhance reliability and manageability.
  - We will be able to restructure localized VME computers into any combination of logical hosts by using virtualization technologies.
- We consider that Serial RaipdIO is the most promising technology for this purpose at present.

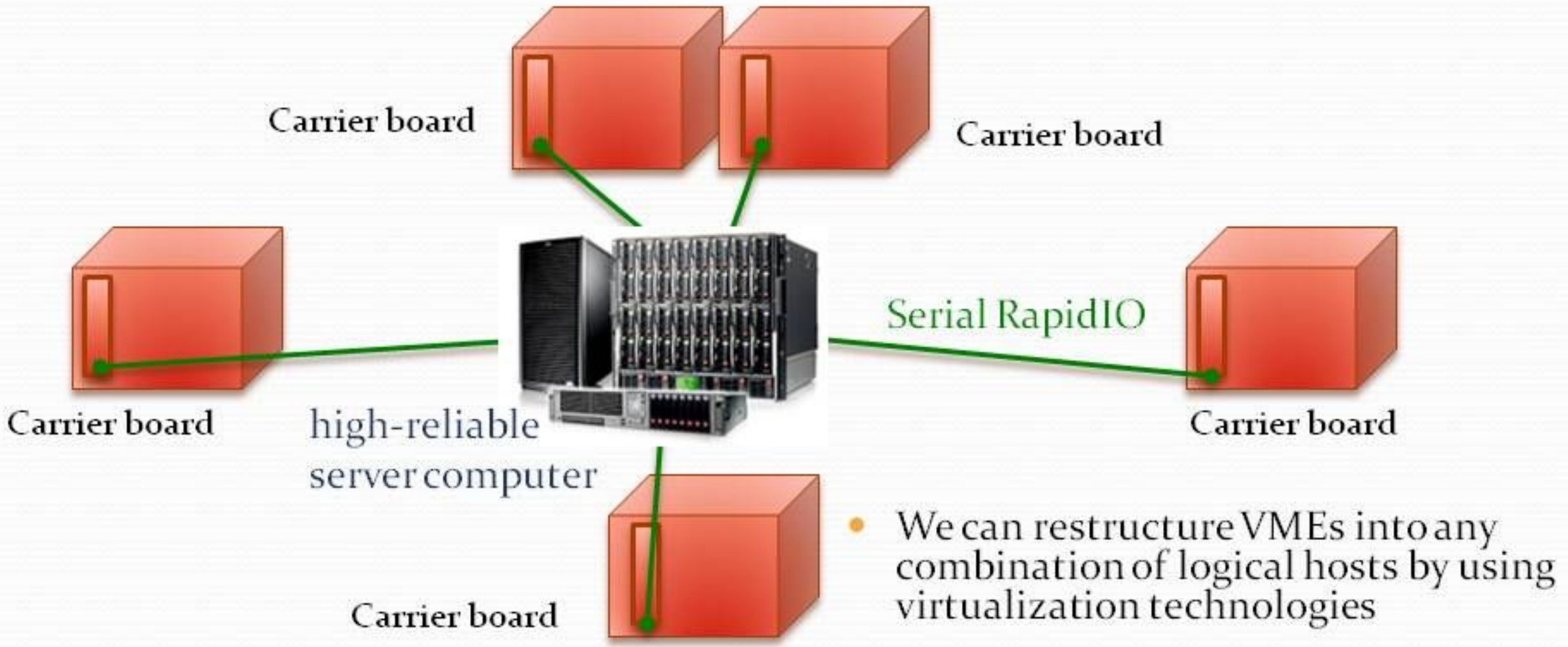
Future applications –cont'

- For SR Magnet PS control, we use 5 localized VMEs.
- All the VMEs are connected with Ethernet.



Future applications –cont'

- We can concentrate all the CPUs into a high-reliable server computer.
- We can control all the PSs from one computer without performance penalties.



- We can restructure VMEs into any combination of logical hosts by using virtualization technologies

Summary

- We have developed the COM Express VME carrier board that works as a VME CPU board with the attachment of a suitable COM Express module.
- The carrier board provides remote management capability such as VMEbus SYSRESET, reset of the COM Express module and KVM-over-IP function independently from the COM Express module.
- The carrier board was designed having remote control capability of VME bus through the PMC/XMC site.
- We will apply the new CPU board to the SPring-8 control system.

Thank you for your attention.