NRC · CNRC

Expanded Very Large Array

CMIB Software Architecture

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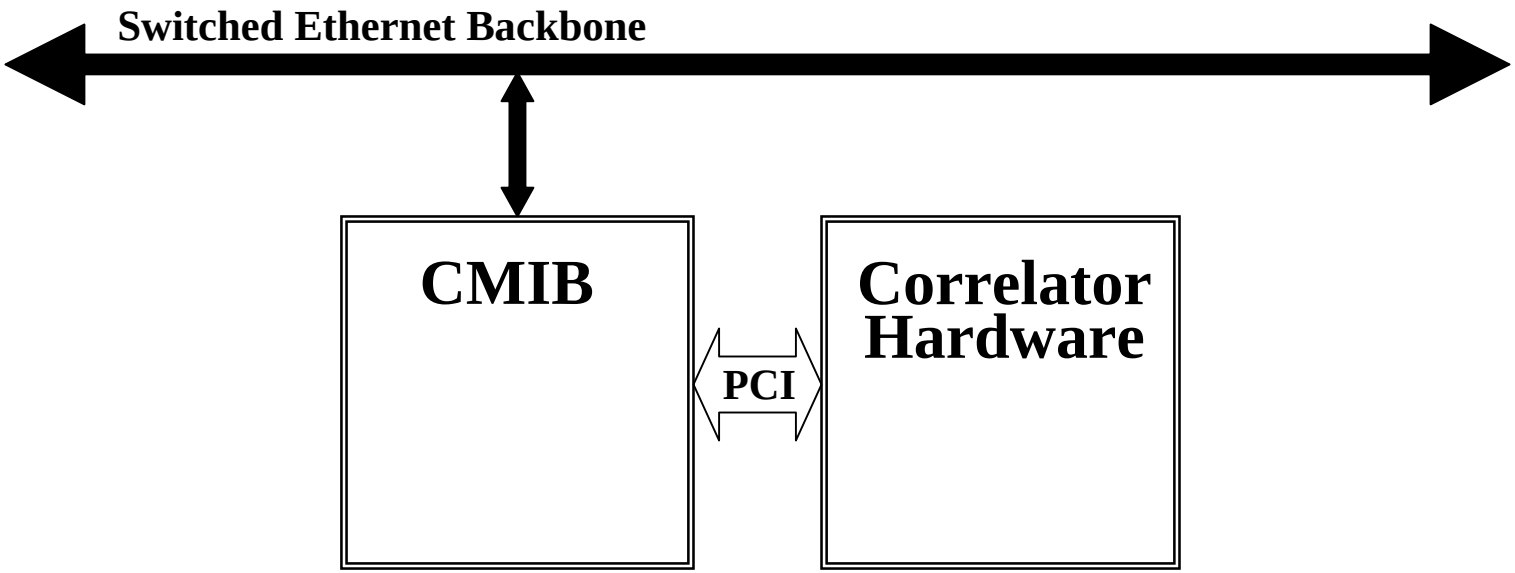
General Topics

- Basic hardware organization/overview
- Operating system overview
- Hardware interface details
- Software interface overview
- Software interface details
- Module access handlers

Basic Hardware Overview

- Correlator Module Interface Board (CMIB)
  - PC/104-Plus form factor
  - 100BaseT Ethernet
  - 166MHz Pentium II (686)
  - 128MB DRAM (SO-DIMM)
  - EIDE/ISA/PCI/USB
  - Keyboard/LPT/Serial/…
- One CMIB for each major correlator board (~300)

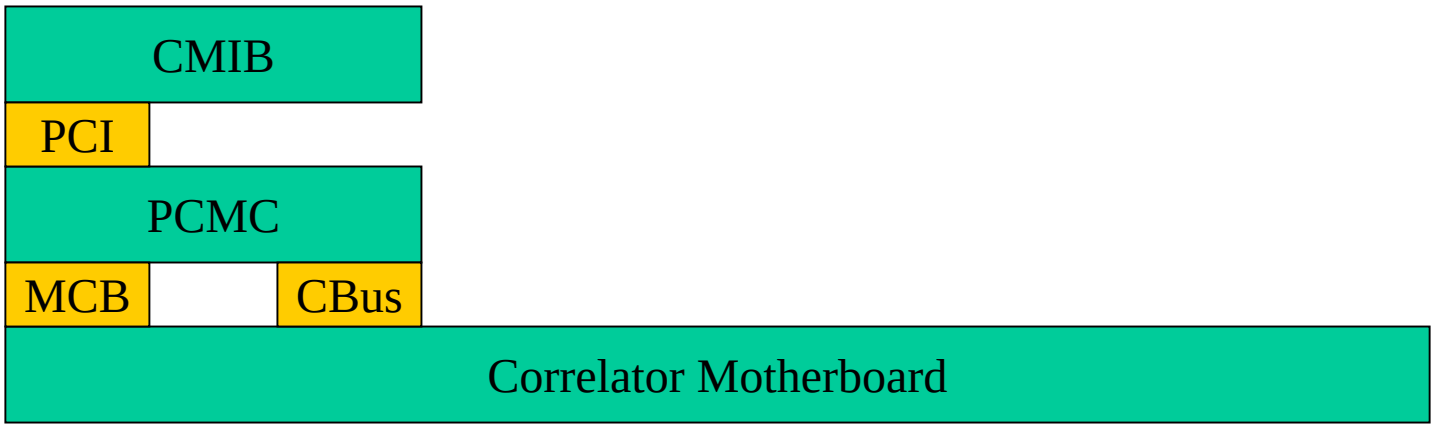
Basic Hardware Overview



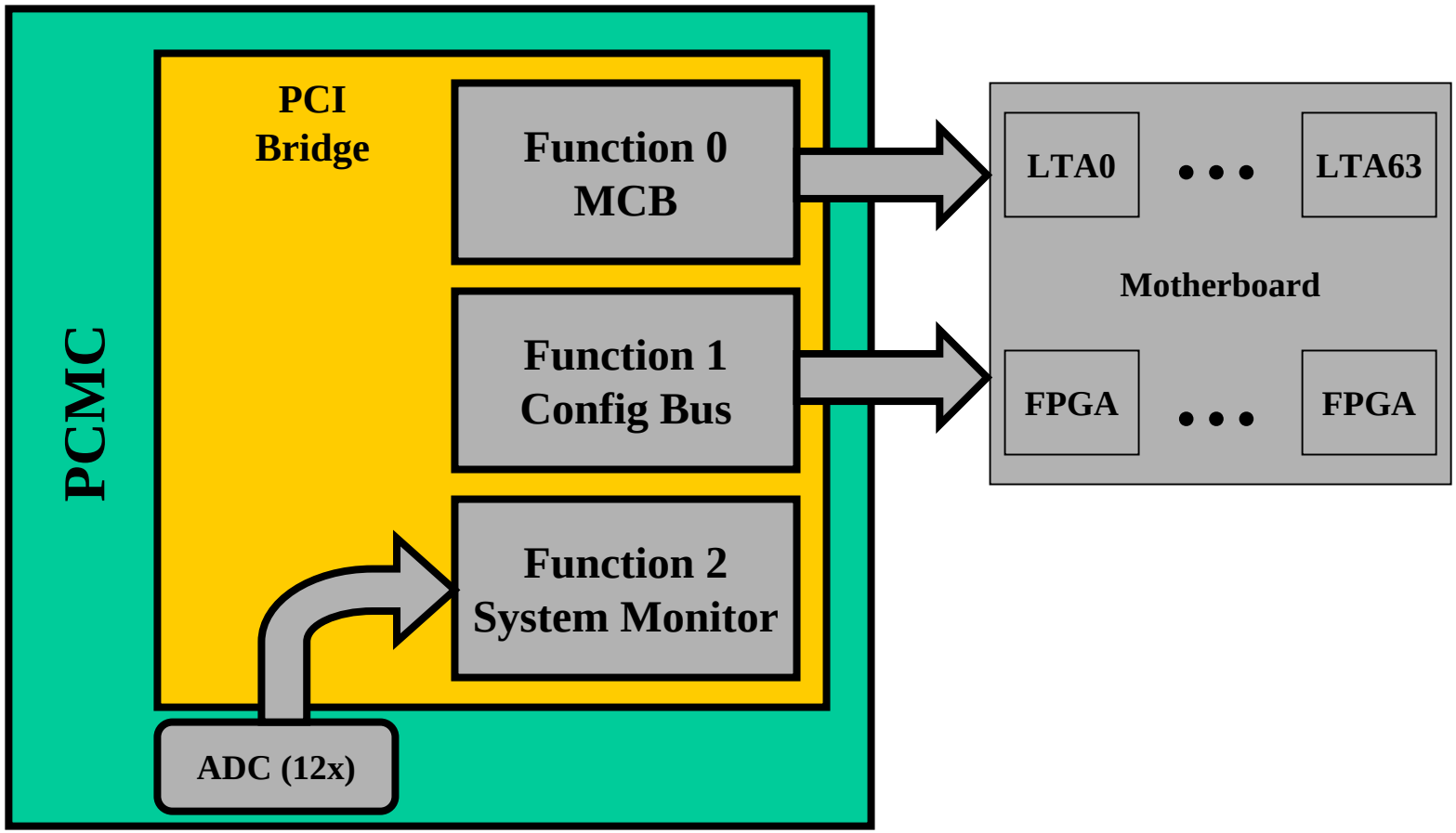
Operating System Overview

- Linux 2.6 series kernel (2.6.7) with preemption.
  - Diskless operation (tftp boot, some RAM disk partitions)
  - Loadable module support (device drivers)
  - Standard GNU tools and libraries.
  - Support SSL connections/sessions
  - Standard web services (Tomcat)

Hardware Interface Details (physical)



Hardware Interface Details



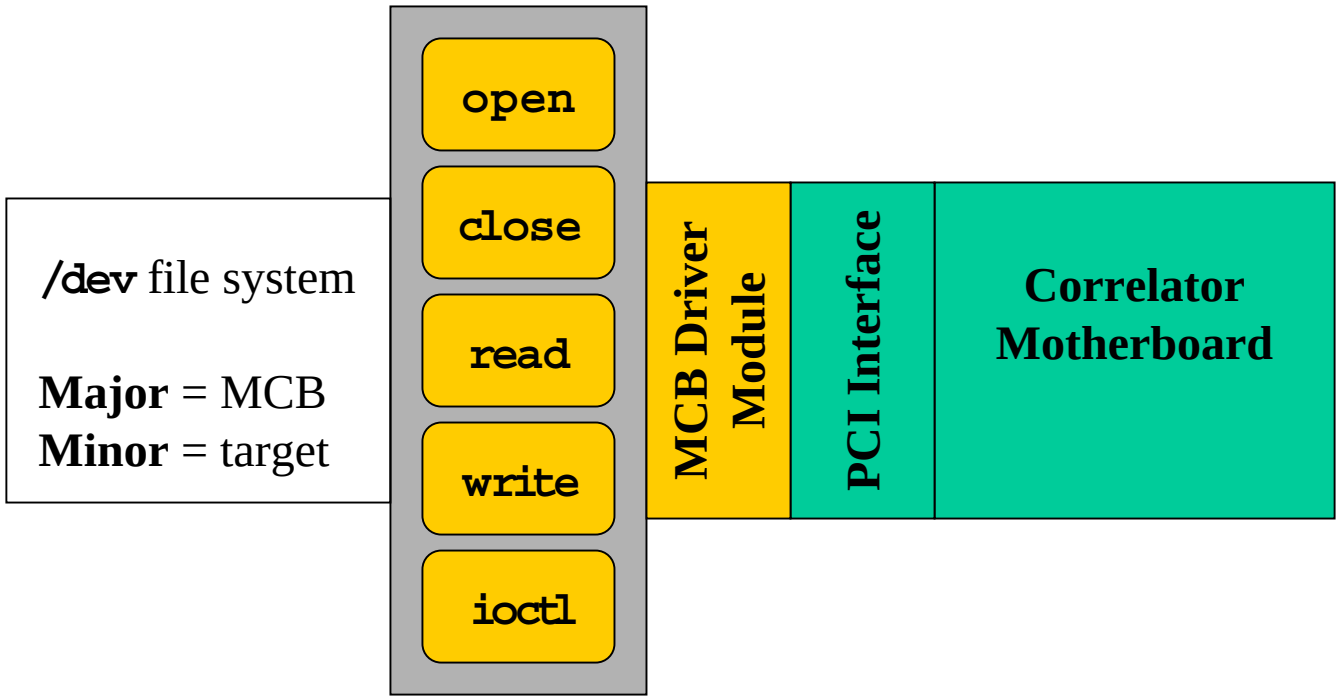
Control Software Overview

- Every hardware module (device) is a file
  - Follows UNIX concept
  - Each ***individual*** hardware device has a device file for read and write of binary data, synchronized to the 10ms system interrupt.
  - Each ***class*** of hardware device (i.e. recirculator chip, LTA chip, etc.) has a device file for XML based configuration and control.
  - Module access handlers (MAH) encode/decode XML and use device's binary interface to pass data.
  - All access methods are thread safe, MAH's can run multiple instances for better transaction load management.

Module Access Handler

- XML used for configuration and control of all modules
  - Each MAH checks XML for form and also verifies contents based on XML schema.
  - MAH performs translations (abstractions) and fills control structures that are passed to modules.
  - Monitor data retrieved from modules is abstracted and translated into XML before being returned to client.
  - The device driver associates clients based on common file descriptor.
  - All XML transactions receive a reply after deployment by the MAH.
- MAHs operate asynchronously.
  - Data is dispatched to the module immediately after decoding.
  - Some modules synchronously act on data in their registers.

Software Interface Overview (MCB)



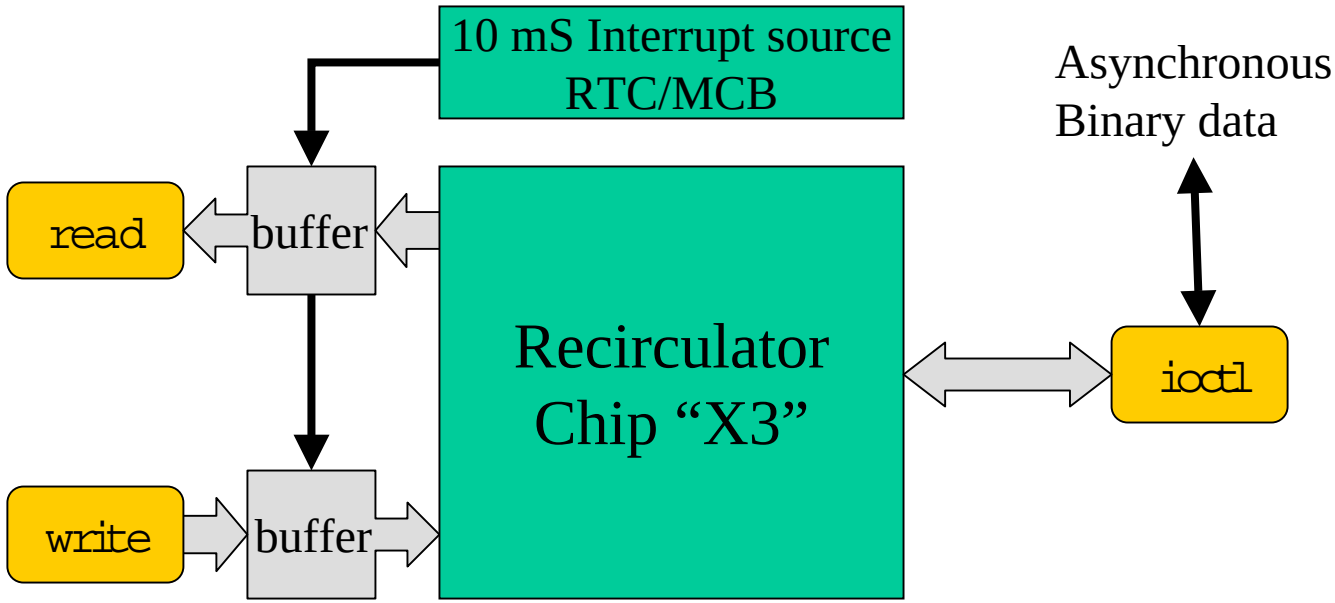
Software Interface Detail (Recirculator binary)

```
cmib% ls -al /dev/recircx3

crw-rw-rw 1 root 664   23, 139 May 22 19:24 recircx3
cmib%
```

“23” is device Major number (MCB)
“139” is device Minor number (recirculator chip X3)
An “open” (via a write or read) to **`/dev/recircx3`** assigns a file descriptor (fd) which is bound to the recirculator methods open, close, read, write, and ioctl. This is a “binary” device interface.

Software Interface Detail (Recirculator binary interface)



Buffer contains Timecodes and HM signal stats in binary, updated (pushed, pulled) every 10 milliseconds.
`ioctl` arguments set/fetch configuration data on demand.

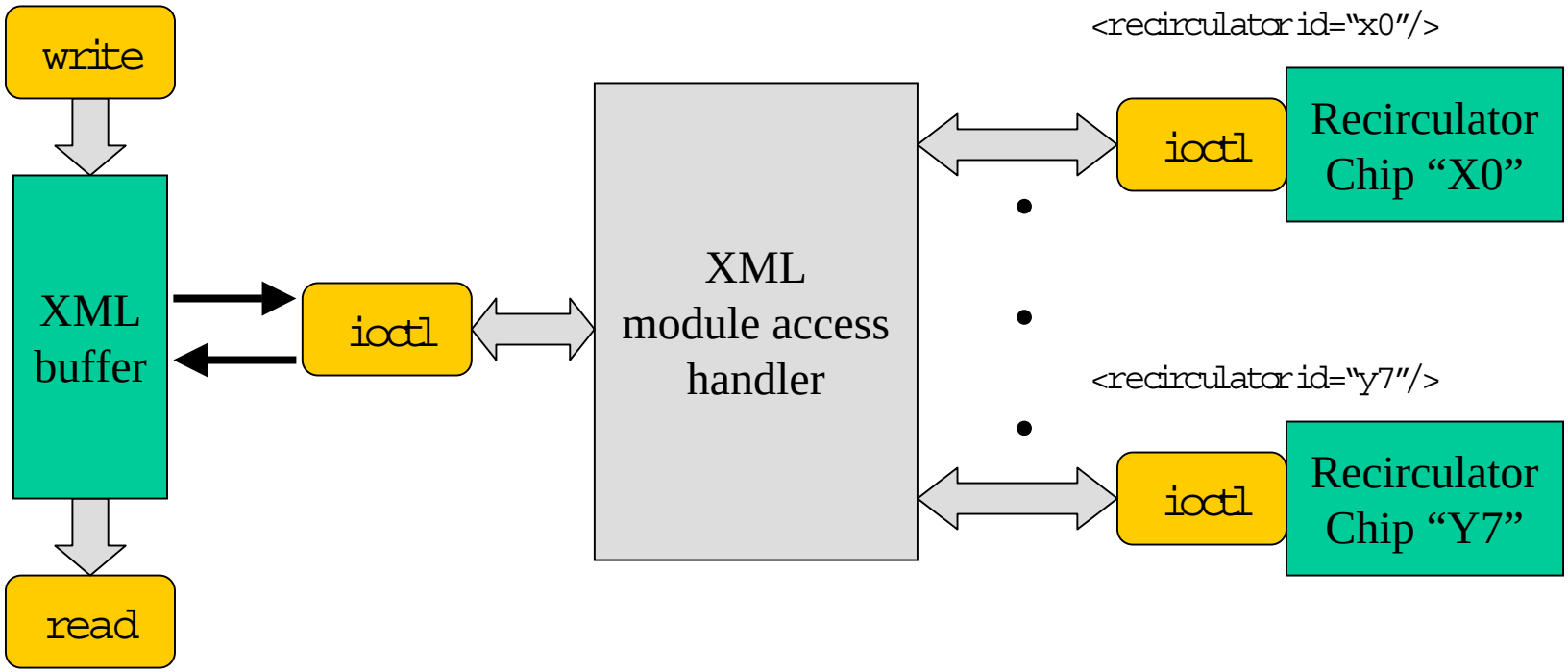
Software Interface Detail (Recirculator XML)

```
cmib% ls -al /dev/recirculator

crw-rw-rw 1 root 664   23, 170 May 22 19:24 recirculator
cmib%
```

"23" is device Major number (MCB)
"170" is device Minor number (recirculator XML interface)
An "open" (via a write or read) to **`/dev/recirculator`** provides XML access to the recirculator class Module Access Handler (MAH).

Software Interface Detail (Recirculator XML interface)



Summary

- Device drivers abstract and unify hardware with operating system
- XML based data exchange for configuration and control
- Binary data exchange for synchronous operations
- All data transfers involve reading/writing to files
- Allows full suite of operating system and application software to access the correlator hardware modules.