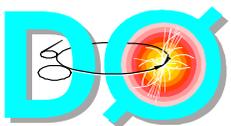


Control System Overview

J. Frederick Bartlett
Fermilab
June 1, 1999



The DØ Control System

- **History**

- ◆ **Run I - CDAQ**

- **Built at DØ**
- **VMS and Pascal**

- ◆ **Platform Independence Decree**

- ◆ **Run II - EPICS**

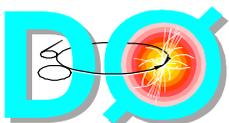
- **Shared with HEP Community**
- **Runs on many platforms**

- **The Standard (Control) Model**

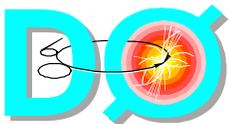
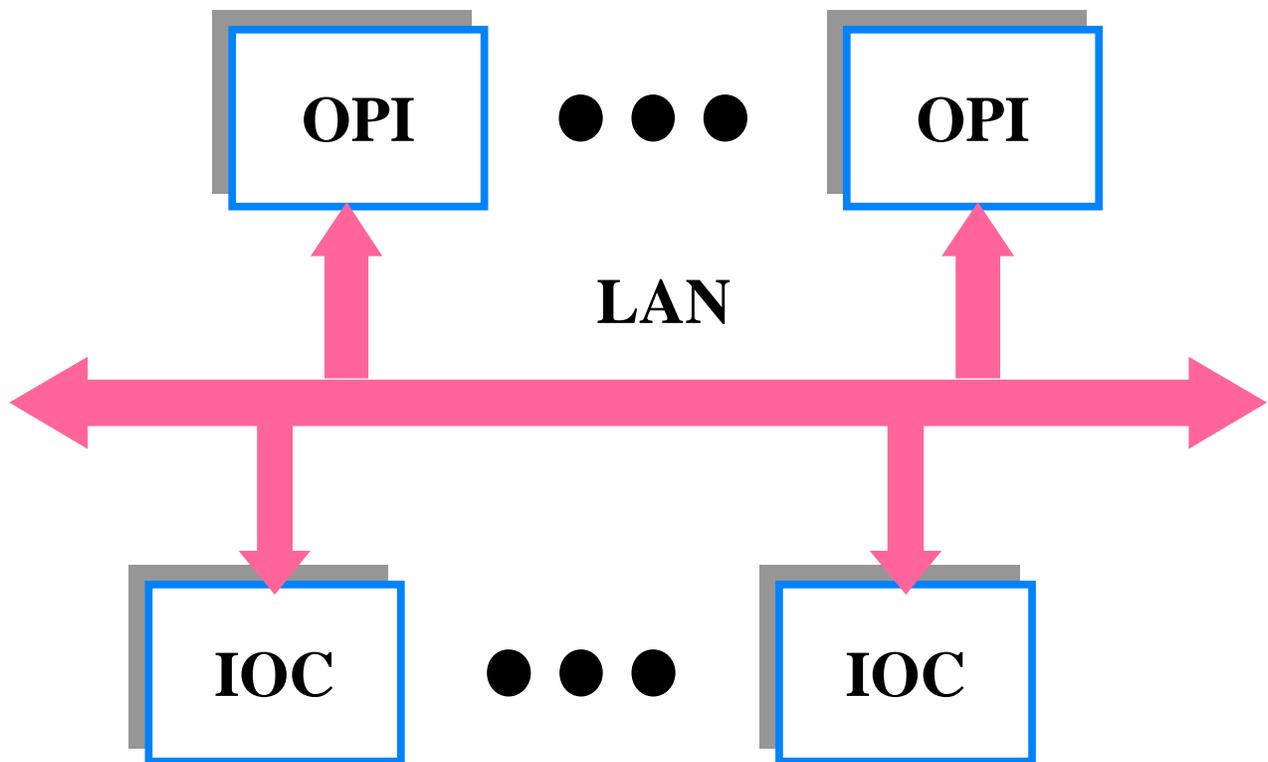
- ◆ **Operator Interface (OPI)**

- ◆ **Local Area Network (LAN)**

- ◆ **Input/Output Controller (IOC)**

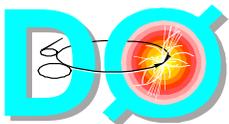


The Standard Model



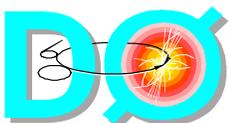
Operating Systems

- OPI (Host)
 - ◆ Operating System
 - UNIX
 - Digital UNIX
 - Linux
 - Windows NT
- IOC (Front End)
 - ◆ Operating System
 - VxWorks
 - Real-Time Linux (later?)
 - ◆ Platforms
 - Motorola 68K (MVME-162)
 - Motorola Power PC (MVME-230x)



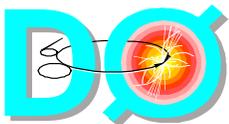
EPICS Characteristics

- **Maintained by HEP and astronomy community**
- **Tools and building blocks for a control system**
- **Distributed database**
- **Scalable architecture**
 - ◆ **OPI's and IOC's may be added dynamically**
- **Channel Access (CA) servers and clients**
 - ◆ **Event driven**
 - ◆ **Portable CA Server**
 - **Written in C++**



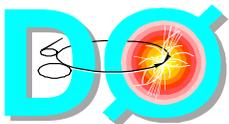
EPICS Characteristics

- **High performance (records processed per second)**
 - ◆ **MVME-162 (68K)**
 - **>5000**
 - ◆ **MVME-230x (Power PC)**
 - **>50000**
- **Extensive collection of applications**
 - ◆ **Database editors**
 - ◆ **Display programs**
 - ◆ **Alarm handler**
 - ◆ **Archiver**
 - ◆ **Many more**



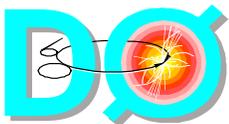
EPICS Channel Access

- **Channel access provides network transparent access to IOC databases**
- **CA Services**
 - ◆ **Search - Find a process variable (PV) by name**
 - ◆ **Get - Get a PV value + optional information**
 - ◆ **PUT - Change the value of a PV**
 - ◆ **Add Event - Add a change-of-state callback to a PV**



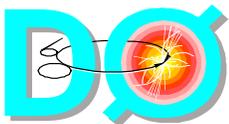
EPICS Channel Access

- **Items returned with a GET**
 - ◆ **Value**
 - String
 - Integer (char, short, int, long)
 - Floating point (float, double)
 - Enumerated menu string
 - ◆ **Optional**
 - Status and severity
 - Time stamp
 - Graphics and alarm limits
 - Control limits
- **Channel access transforms**
 - ◆ numeric formats
 - ◆ native types

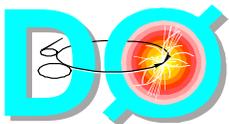
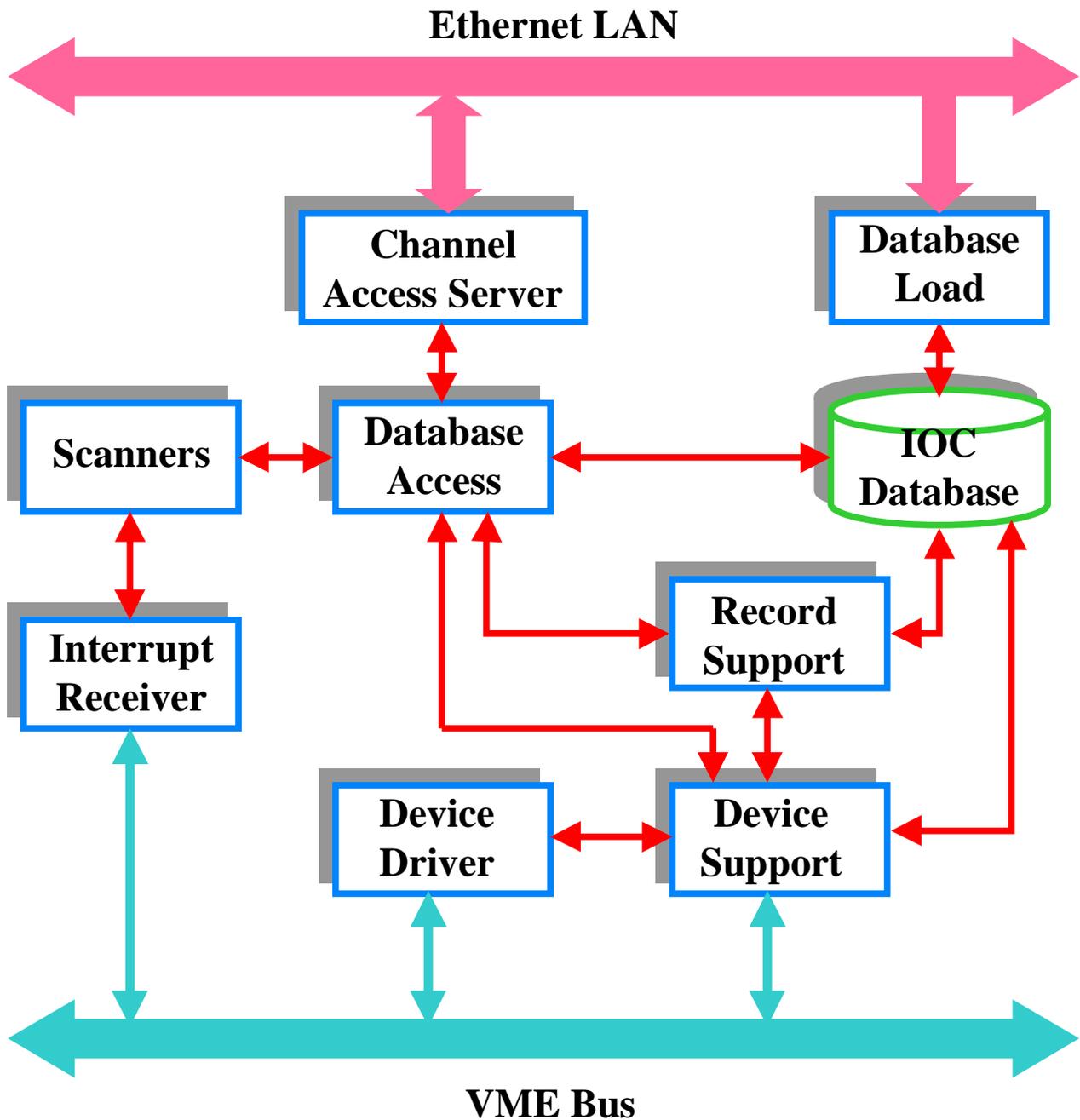


Asynchronous

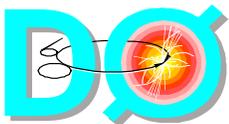
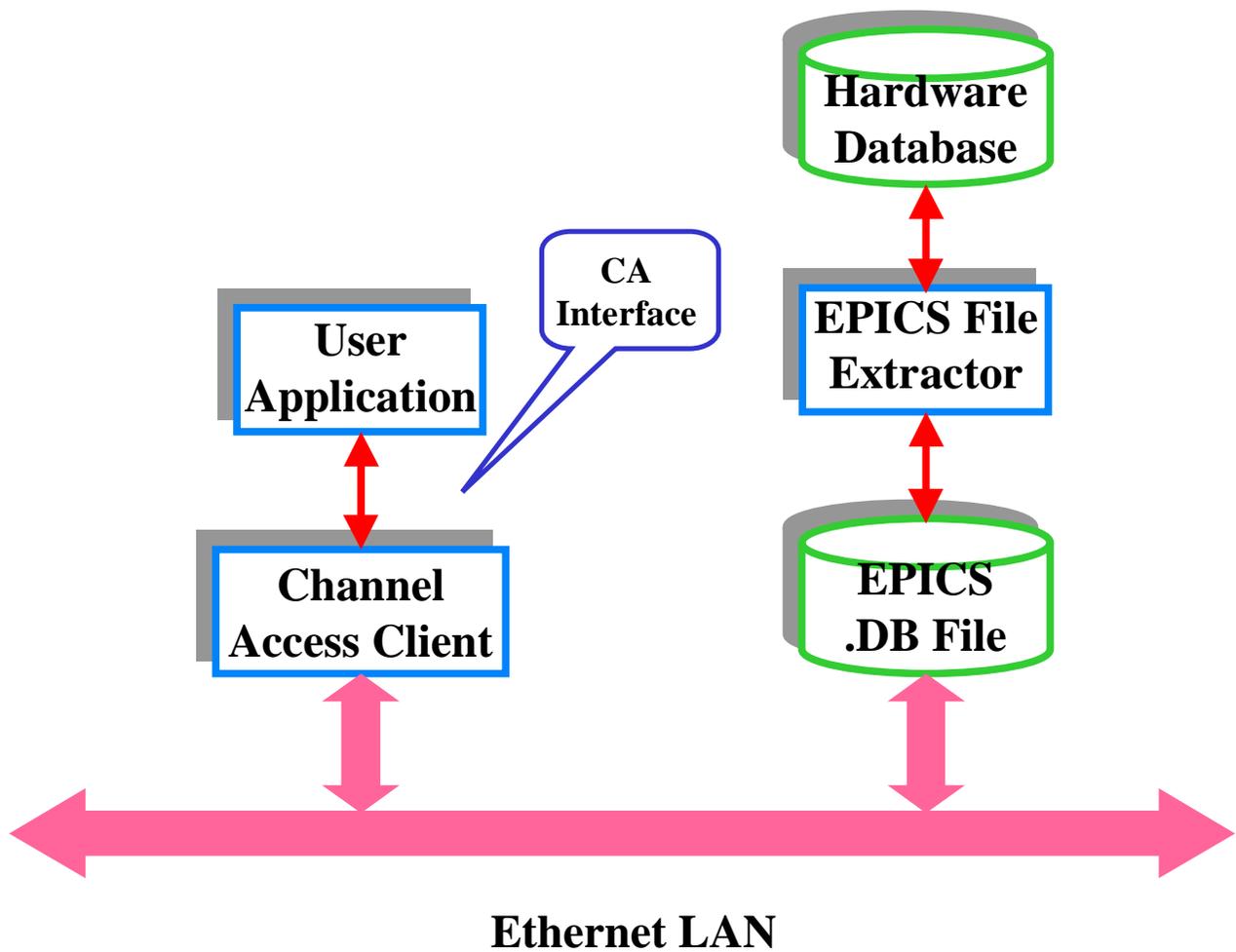
- Provides a callback mechanism for change of state
 - ◆ Alarms
 - ◆ Value change
 - Any
 - Deadband
 - Archival



IOC Components

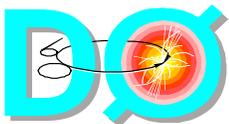


OPI Components



Record Scanning

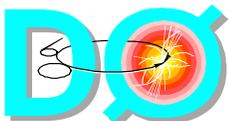
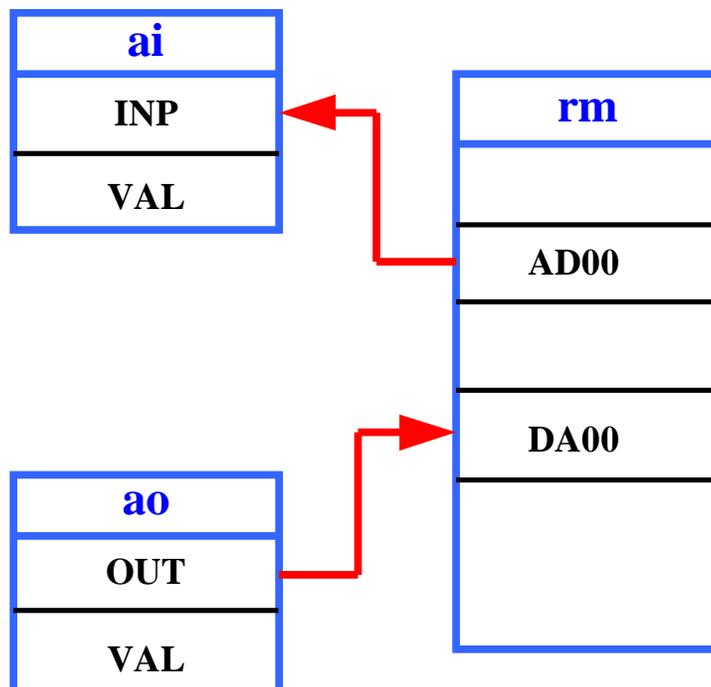
- **Periodic - Process at a periodic rate**
 - ◆ **Standard**
 - **0.1, 0.2, 0.5, 1, 2, 5, 10 seconds**
 - ◆ **DØ may add other periods**
- **Event - Process when an event is posted**
 - ◆ **255 events**
 - ◆ **Begin run, End run, ...**
- **I/O Event - Process on an external interrupt**
- **Passive - Process only when requested**



Database Access Levels

- **Record**

- ◆ Provides a generic user view of a device + attributes
- ◆ Simple records may be linked to provide complex behavior



Database Access Levels

- **Device**

- ◆ **Transforms device-specific characteristics**

- ◆ **Types**

- **VME bus**

- **MIL-1553B bus**

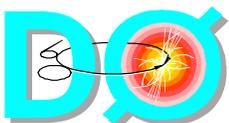
- **GPIB bus**

- **CANbus**

- **CAMAC**

- **Soft (linked to another record)**

- **Symbol (linked to**



Database Access Levels

- **Driver**
 - ◆ Required when a device generates interrupts

