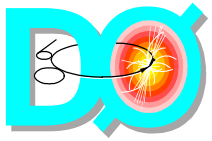


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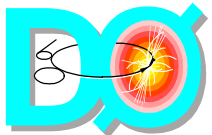
# EPICS IOC Extensions

**J. Frederick Bartlett**  
**Epics 2001**

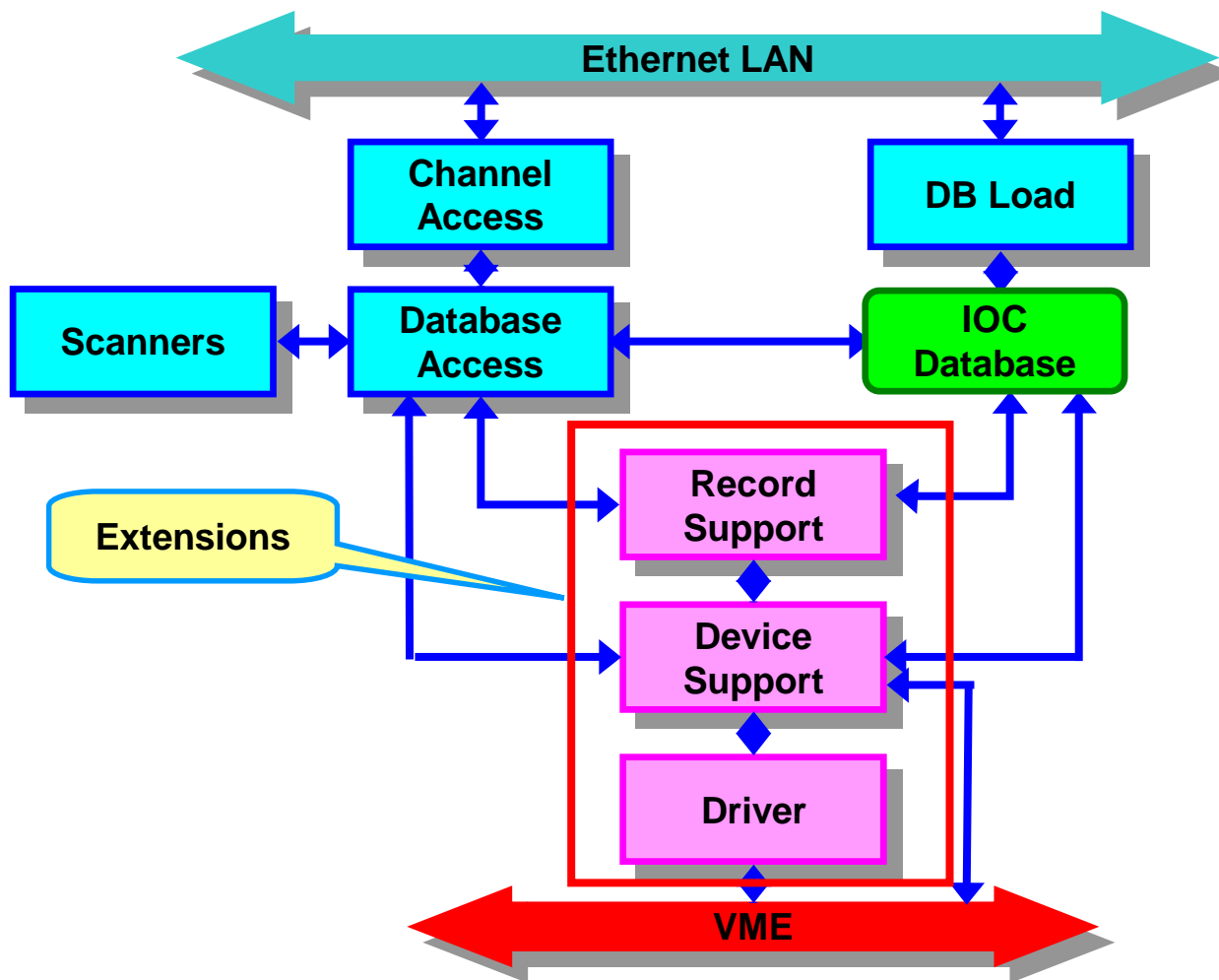


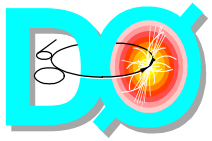
# Outline

- **EPICS IOC Structure**
- **Extending EPICS**
- **MIL/STD1553B Fieldbus Driver**
- **hvRec – A High-Voltage Record**
- **devVme – VME bus Access**
- **devFunct – Function Access**
- **devSub – Array Component Access**



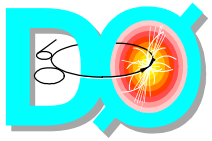
# EPICS IOC Structure





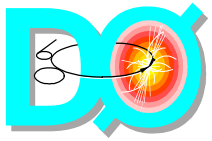
# Extending EPICS

- **Functionally extending the IOC**
  - ◆ New device support – most frequent
  - ◆ New record support
  - ◆ New driver support – least frequent
- **Record/Device transition**
  - ◆ Level – what goes into the record and what goes into the device
  - ◆ Often not well understood
  - ◆ EPICS documents and tutorials offer minimal guidance in selecting the level



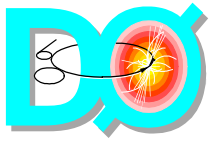
# Extending EPICS

- Record/Device interface level (cont)
  - ◆ Records
    - Encapsulate general behavior of some functional class
    - Not just a data type
    - May replace linked collections of other records when context must be shared
  - ◆ Devices
    - Adapt records to hardware
      - ◆ Implication – records exist before devices



# MIL/STD1553B Fieldbus Driver

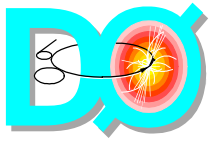
- **Properties**
  - ◆ Low speed serial (1 MHz)
  - ◆ Robust
  - ◆ Used in commercial and military aircraft (fly-by-wire systems)
  - ◆ Very low noise
- **EPICS extensions**
  - ◆ Driver
  - ◆ Device support for standard EPICS records



# hvRec – High Voltage Record

- **Purpose**

- ◆ **Control and monitor an individual HV channel**
- ◆ **Add high-level operations to a generic voltage generator**
- ◆ **Centralize trip and error management**

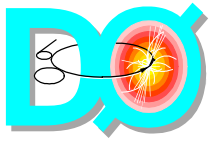


# hvRec – High Voltage Record

- **Properties**

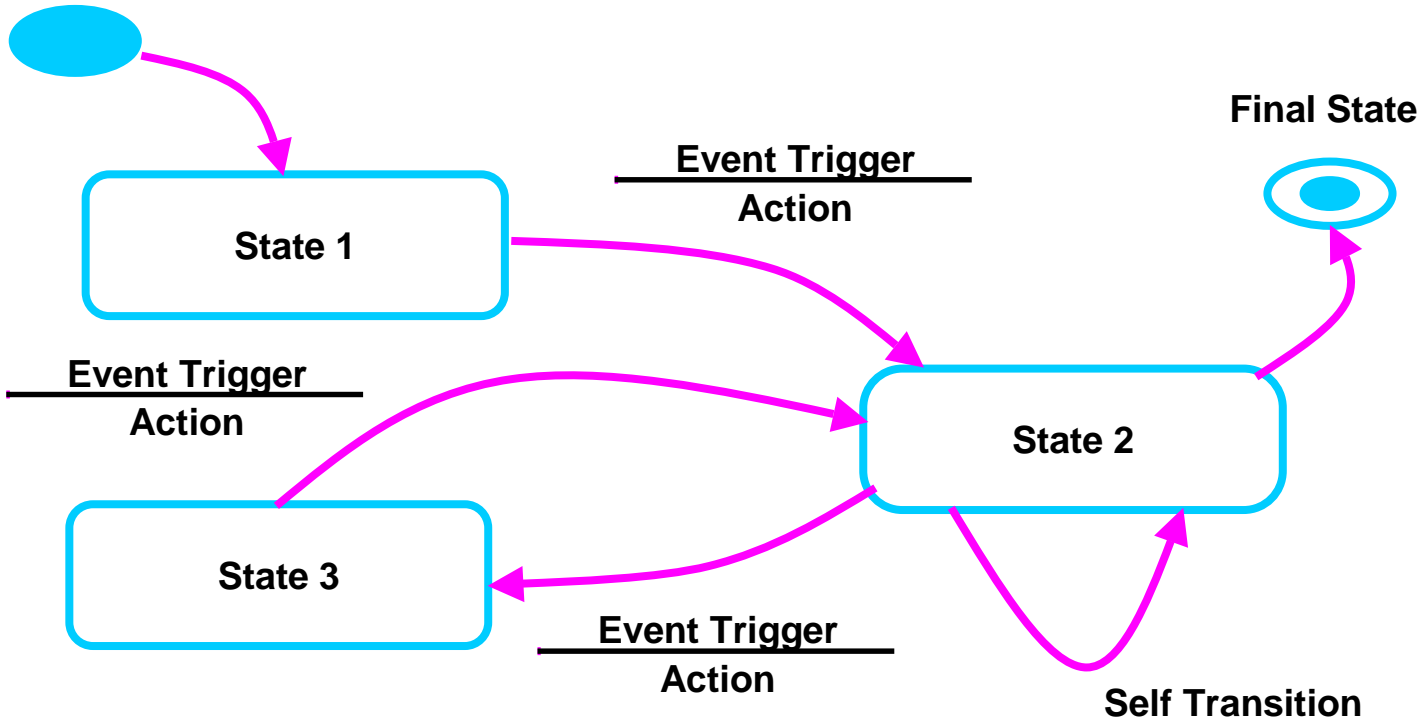
- ◆ High-level device interface for a programmable voltage generator
- ◆ Sequential state machine model (limited implementation of Harel Statecharts)
- ◆ Optional fast and slow histories
- ◆ Corrective ramp algorithm
- ◆ Access restricted states

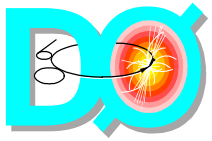




# A Simple State Machine

Initial State

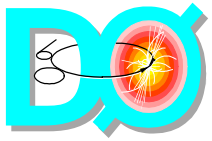




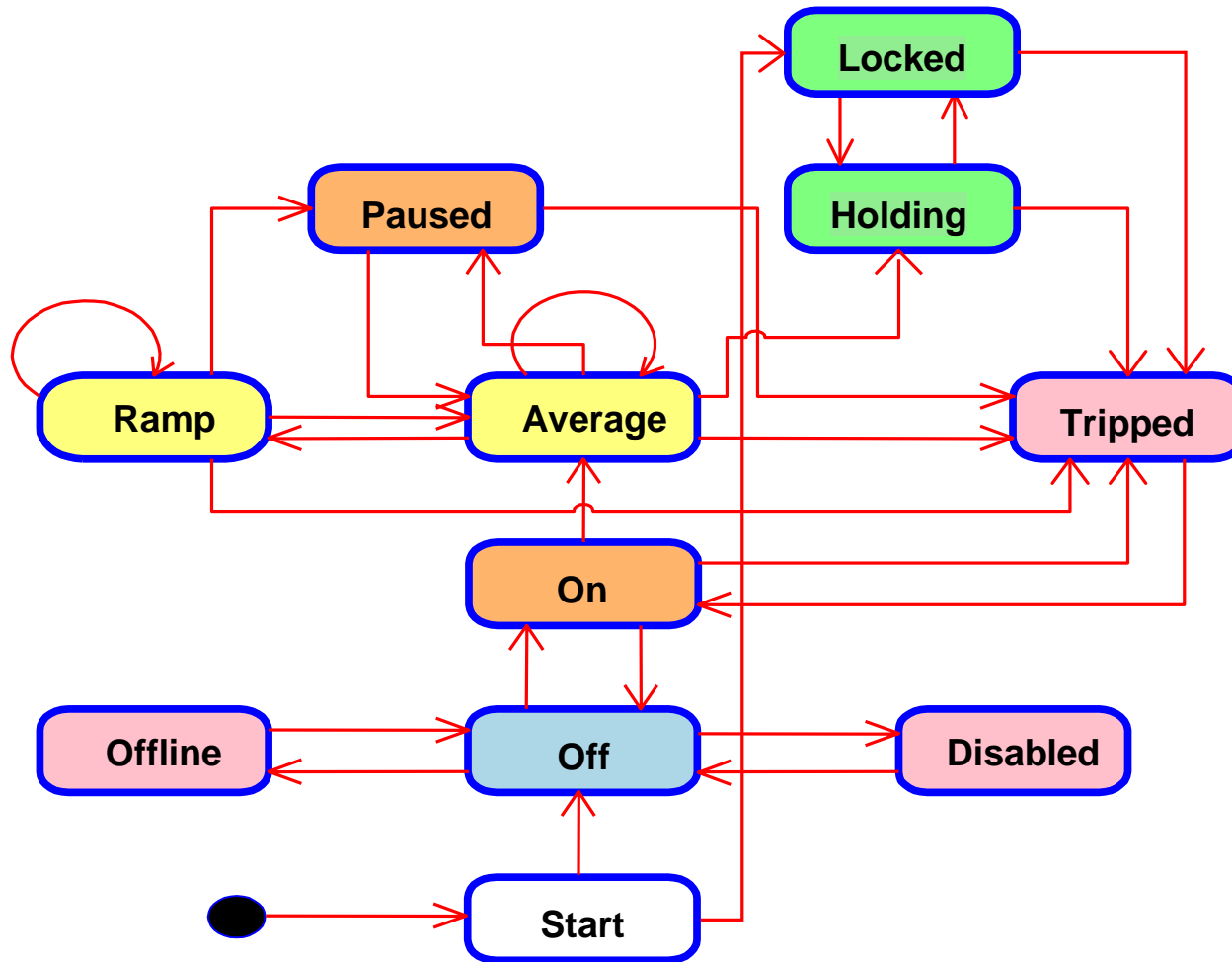
# Harel Statechart

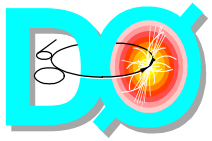
## Entry and Exit Actions





# hvRecord - State Diagram

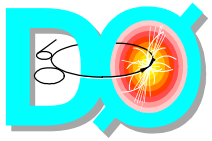




# devVme – VME bus access

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- **Purpose**
  - ◆ **Provide full access to VME bus**
    - **Standard EPICS device support lacks general addressing**
- **Record support**
  - ◆ **Ai, ao, bi, bo, mbbi, mbbo, mbbiDirect, mbboDirect, waveform**
- **Single load module**



# devVme – VME bus access

- INP/OUT field

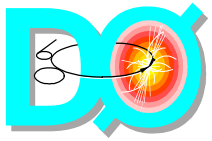
- ◆ Instrument format

- ◆ Field components

- V – VME base address (hex)
- O – VME offset address (hex, optional)
  - ◆ Useful in database templates
- A – Addressing mode (A16, A24, A32)
- D – Data size (D8, D16, D32)
- P – Probe access (vxMemProbe) (optional)

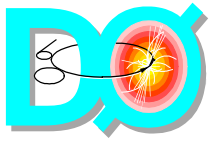
- ◆ Template

- “#@ V<base> O<offset> A<mode> D<size> P”



# devFunct – Function Access

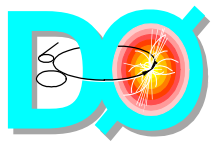
- **Purpose**
  - ◆ Provides an alternative to the vxWorks variable interface
  - ◆ Calls a function rather than accessing a variable directly
    - Used where process synchronization is required
- **Records supported**
  - ◆ so (others being added)
- **Single load module**



# devFunct – Function Access

---

- INP/OUT field
  - ◆ Instrument format
  - ◆ Field components
    - F – Function name
  - ◆ Template
    - “#@ <name>”
- Single load module

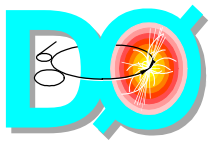


# devSub – Array Component Access

---

- **Purpose**
  - ◆ Provide a device access alternative to the subArray record
  - ◆ Variant of “soft” device support
  - ◆ Efficient use of memory
- **Records supported**
  - ◆ None – being implemented
- **Single load module**





# devSub – Array Component Access

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- **INP/OUT field**
  - ◆ **Instrument format**
    - **Should be link format**
  - ◆ **Field components**
    - **PV name and standard options**
    - **D – Data type**
    - **O – Offset**