

# EPICS Channel Access Enhancements for LANSCE Timed and Flavored Data

J. Hill

# Overview

- Introduction
- LANSCE Requirements
- Bounded Feature Set
- EPICS Event Queue
- Event Queue Upgrade
- Milestones

# LANSCCE Requirements

- LANSCE timing and flavoring of data
  - Flavoring
    - Logical configuration of beam gates
  - Timing
    - Time offset of a sample within a beam pulse
- Many permutations
  - Too many to, a priori, install EPICS records for all of them
  - Channel Access client must somehow specify timing and flavoring when it subscribes

# Bounded Feature Set – Near Term Release

- Many features proposed for EPICS version 4
  - Release schedule is uncertain
- LANSCE timeline requirements and EPICS version 4 timeline may not coincide
- The proposal is to add to EPICS strictly what LANSCE needs and thereby obtain a more predictable release schedule
- Nevertheless, an incremental step along the path to version 4 is desirable

# EPICS Fundamentals

- Channels and Process Variables
  - A channel is a virtual communication link to a process variable
    - We can perform read, write, and subscribe operations over a channel
- Publish and Subscribe
  - Clients subscribe for updates
  - Servers publish updates to multiple clients
  - Records post state change events to servers

# EPICS Event Queue – A Pivotal Component

- Tying high priority deterministically scheduled activities to the low priority load non-deterministic server component
  - The event queue guarantees that this value/alarm status/time stamp tuple are consistent
  - It is *essential* that we minimize what impact client induced load has on record processing threads

# EPICS Event Queue – Theory of Operation

- Records execute at relatively high priority, server executes at relatively low priority
  - Record processing *never* blocks for slow clients
- Record is producer and client is consumer
  - Server production rate might exceed consumption rate of client or network – queuing system needs to serve dual purposes
    - Burst
      - Attempts to avoid discarding updates
    - Sustained
      - Keep subscriptions current
      - Intentionally discard intermediate updates
      - Do not introduce time delays

# Current Event Queue is Quite Inflexible

- The *only* parameters that can be correlated together in time with any surety over Channel Access are
  - Scalar Value, Time Stamp, Alarm Status
    - The exception is of course after the fact correlation using the time stamp
  - This is very inflexible
    - It does not allow clients to specify their data capture constraints
    - Array value change events are not recorded on the event queue
    - It doesn't allow for on the fly application driven experiments needed at LANSCE

# Event Queue Upgrade

Upgraded Record Specific  
Event Parameter Set

Scalar or *Vector* Value  
Time Stamp  
Alarm Status  
...

Upgraded Device Specific  
Event Parameter Set

LANSCE Beam Gate  
Specification

Record

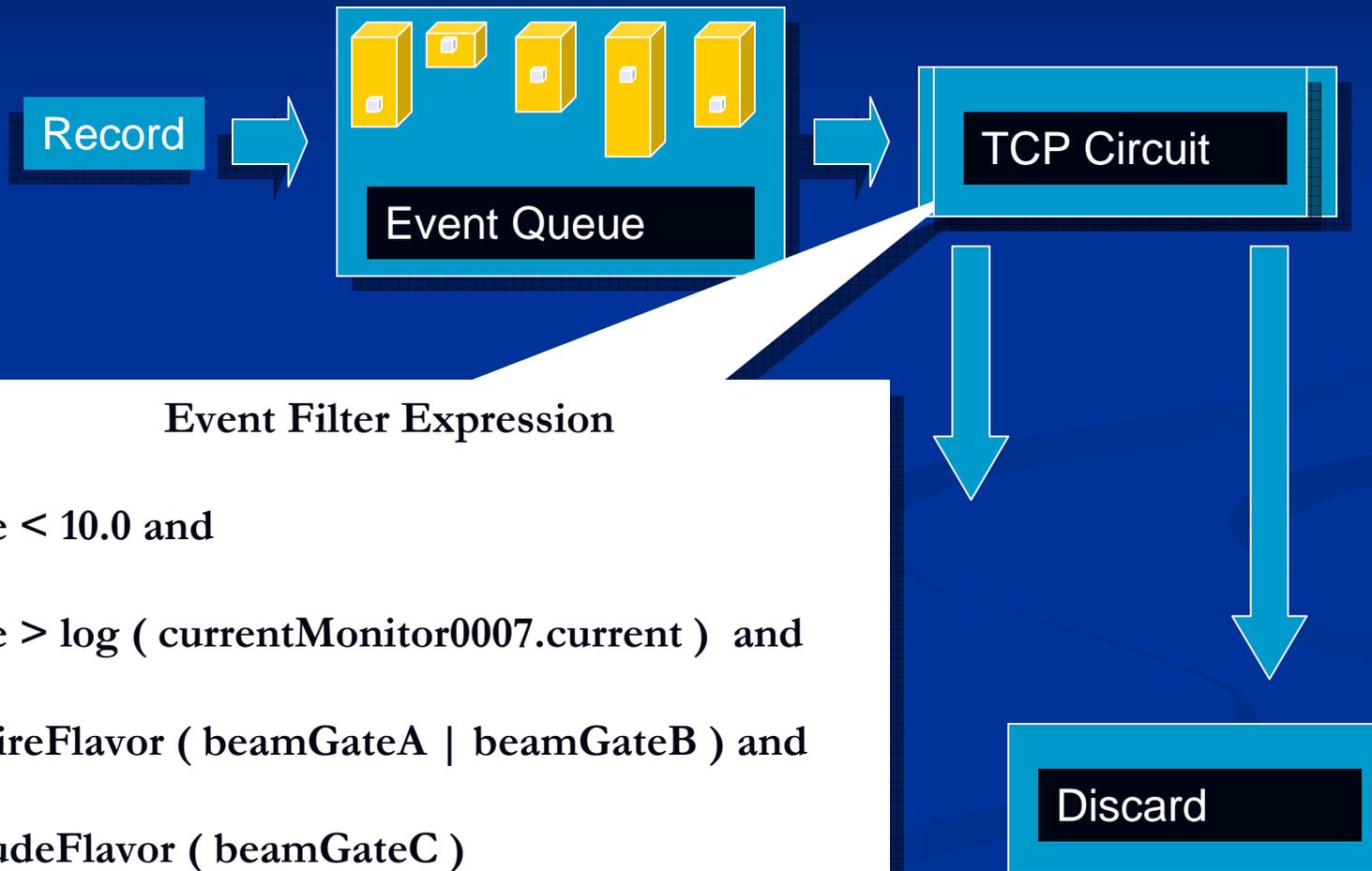


CA Server

# Event Queue Memory Management

- Smart Pointers to Data Access Interfaced Objects
  - Reference counted
    - Increments when smart pointer is copied
    - Decrements when smart pointer is destroyed
    - Release callback when count decrements to zero
- Memory Management
  - Handled by event posting agent
  - Can be free list based

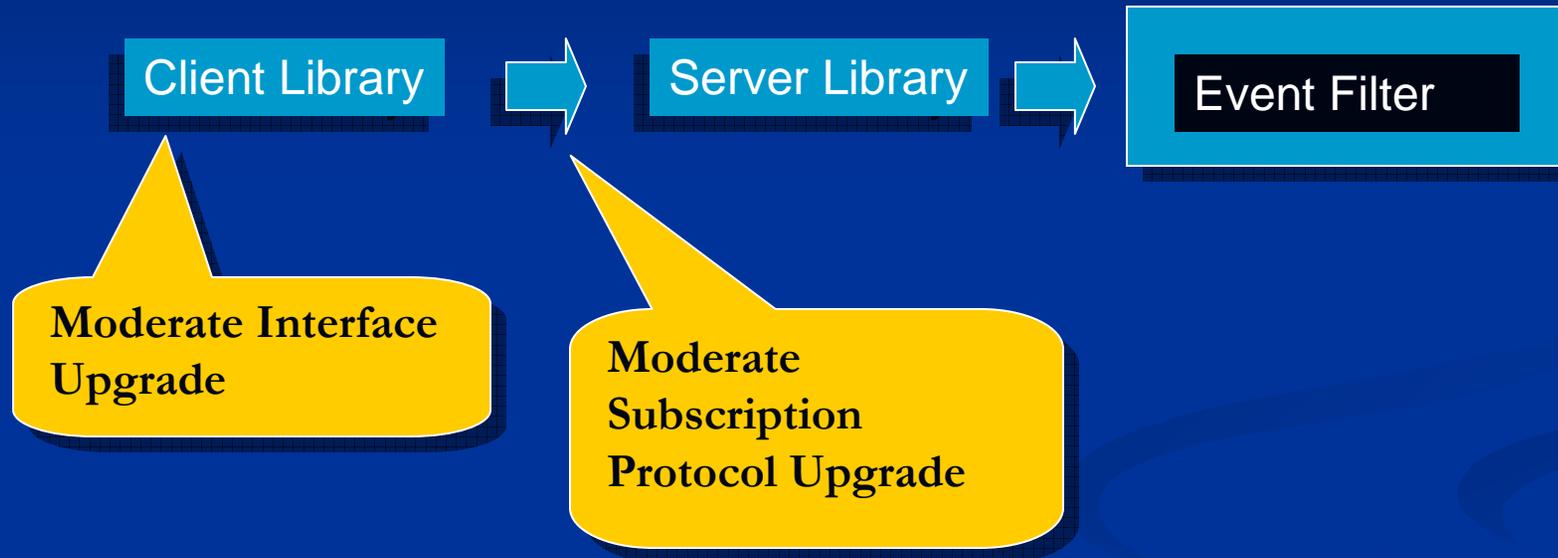
# Event Filter Upgrade



# Event Filter Implementation

- Could be based on the same library that the calc record uses
  - Would prefer however to base expressions on property names instead of  $\{A, B, C, ..\}$  as is currently the case with the CALC library
- Another possibility is Majito
  - Majito is open source and has JIT compiler

# Event Filter Configuration Upgrade

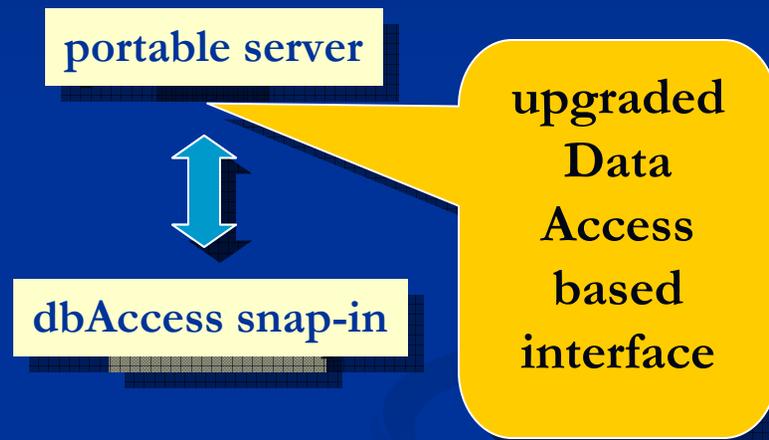


# Data Access Interfaces for DBR Types

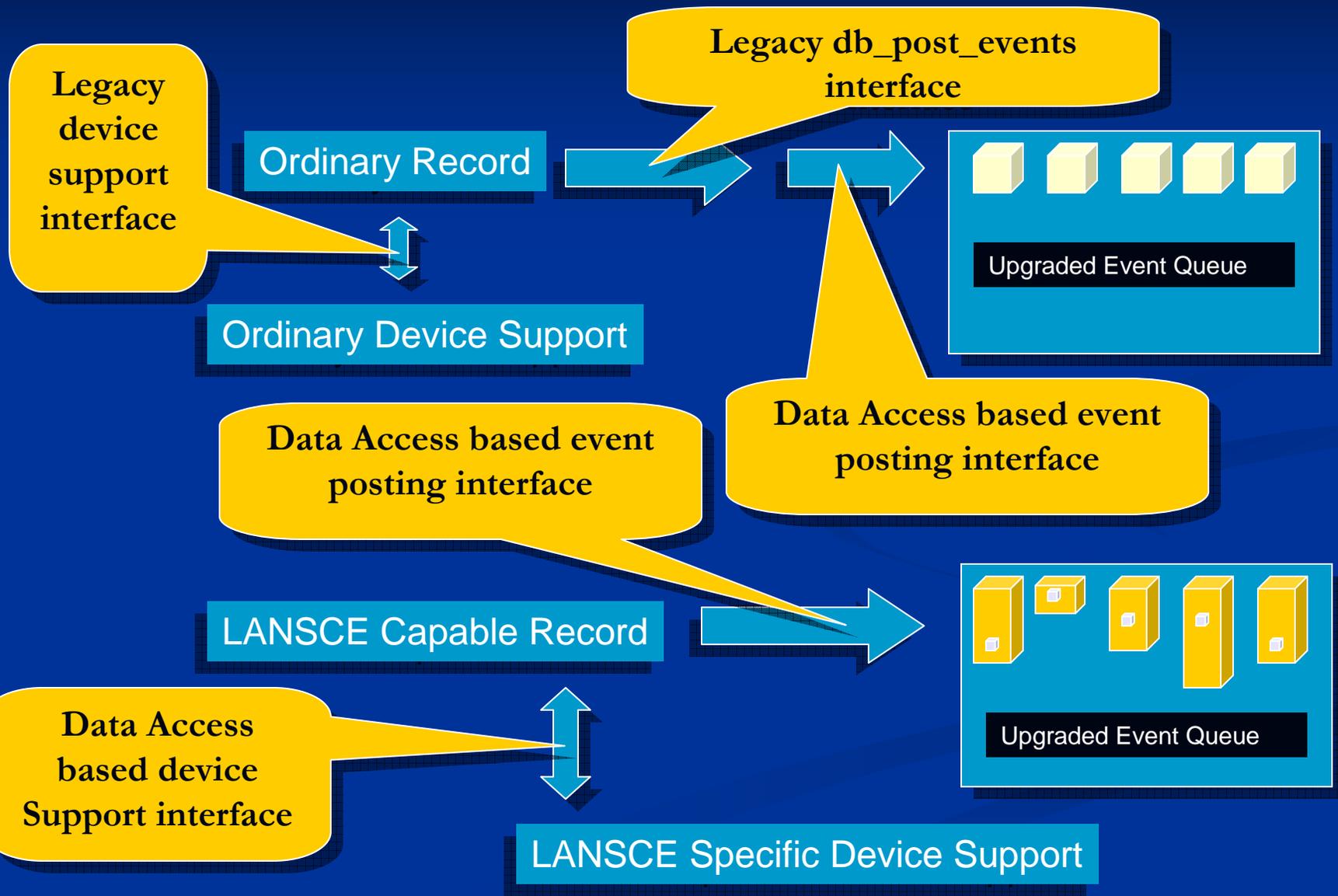
CA Type Code
DBR_CHAR
DBR_SHORT
DBR_ENUM
DBR_LONG
DBR_FLOAT
DBR_DOUBLE
DBR_STRING
DBR_STS_<PRIMITIVE TYPE>
DBR_TIME_<PRIMITIVE TYPE>
DBR_GR_<PRIMITIVE TYPE>
DBR_CTRL_<PRIMITIVE TYPE>
DBR_PUT_ACKT
DBR_PUT_ACKS
DBR_STSACK_STRING
DBR_CLASS_NAME

Data Access  
Interfacing Adapter

# Server Implementation Consolidation



# LANSCAPE Capable Waveform Record



# Milestones

