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# Gretina Controls and Readout

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# Topics



- Slow Controls and EPICS
- Data Flow Diagrams
- A bit about Readout
- Conclusion

# Slow Controls



- Operator Interfaces
- Configuration Database
- Controls Logging
- Alarm Handling
- EPICS Realtime Controls
- Database Compute Farm Controls
- Less than 10K channels

# EPICS Intro



- Experimental Physics and Industrial Control System. Industrial?
- Real-time “Database”
- Network Layer – Channel Access
- Clients – operator interfaces, etc
- Servers – support database records
- Database configuration

# EPICS Database



- Its not an RDB
- Record types
  - Ai, ao, bi, bo, calc, fanout, subroutine
- Scheduling and processing options
  - Periodic, interrupt, forward links, on change
- Hardware drivers connect to record types
  - Many record types correspond to hardware register types
- Records have many fields, some common, some record type specific

# Channel Access



- Mediates network communication between clients and records on servers
- Unit of access is the record field
- Finds records on the network by name
- Allows gets, puts, and monitors
- Reconnects if server or network goes off
- Performs many data type conversions implicitly.
- Has a security system to control access based on user account and/or client computer id.

# Channel Access Clients

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- Extensible Display Manager – edm
- Archiver
- Gateway
- Alarm Handler
- State Notation Language Sequencers
- Command-line get, put
- Interface libraries for C, perl, tcl, matlab, labview, python, java, etc

# Channel Access Servers



- iocCore
  - Processes databases
  - Channel access Server
  - Runs on vxWorks, linux, rtems, etc
  - Multiple prioritized tasks to support real-time processing if OS supports it.
  - An instance is called an IOC, or I/O controller.
  - Usually one instance on a RTOS, can have many per linux box.

# Database Configuration

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- Database fields hold hardware configuration info, and the database records are the hardware interface at runtime
- Database Configuration Tool (DCT)
  - Work “offline” – database loaded after construction
  - DDL, VDCT, spreadsheets, RDBs
- Can handle repeated database patterns by multiple instantiation with macros

# RDB to EPICS Db



- Generate part of EPICS Db from RDB
  - RDB reports hardware settings in EPICS Db format, which are combined with DCT-generated part
- Generate entire EPICS Db from RDB
  - The DCT is an RDB client program, EPICS Db fully represented in RDB
- Various hybrids can be imagined but provide difficulties
- Open area for new development

# Slow Controls Again



- Operator Interfaces
- Configuration Database
- Controls Logging
- Alarm Handling
- EPICS Realtime Controls
- Database Compute Farm Controls
- Less than 10K channels

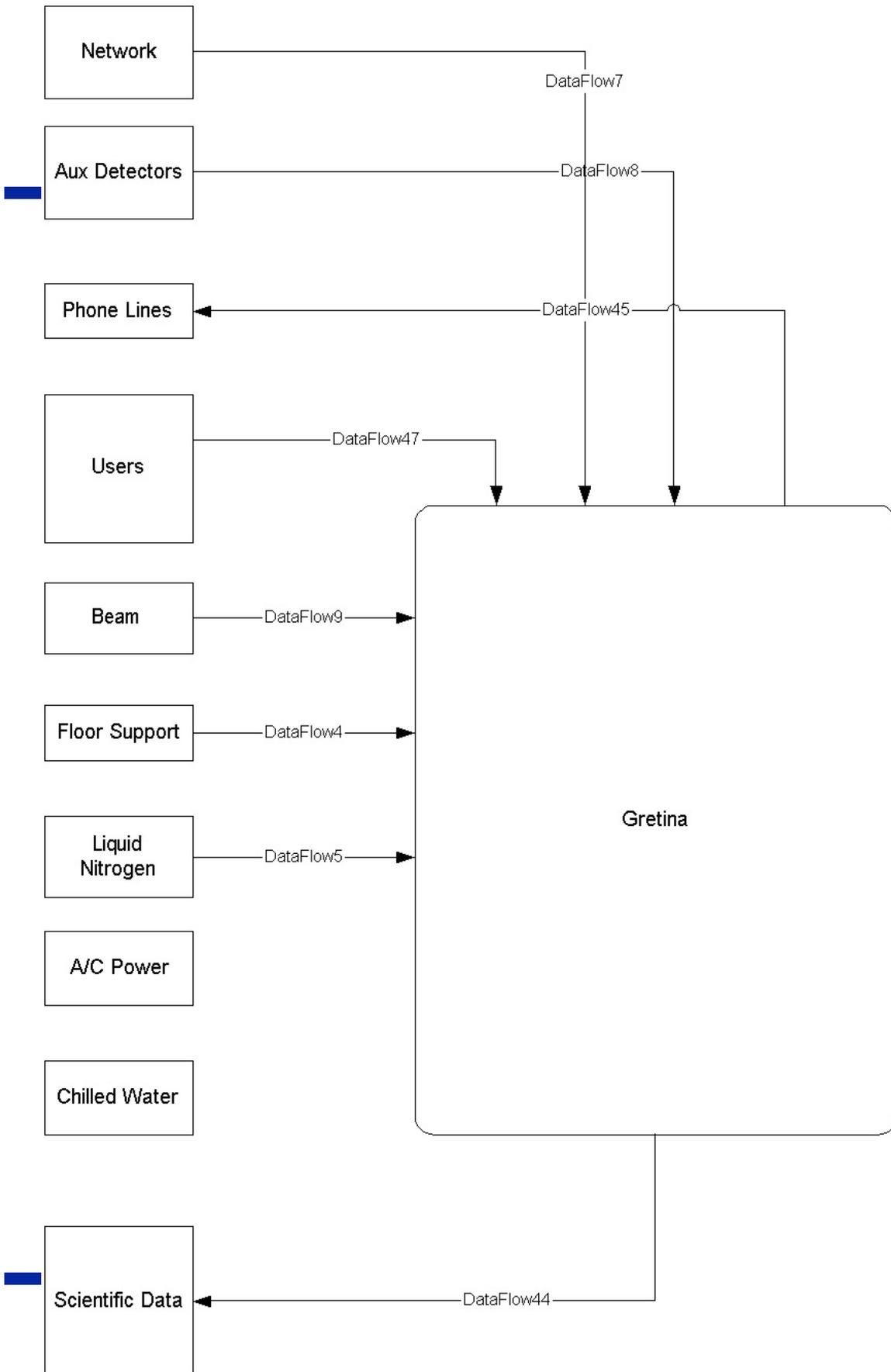
# EPICS Facilitates Collaboration

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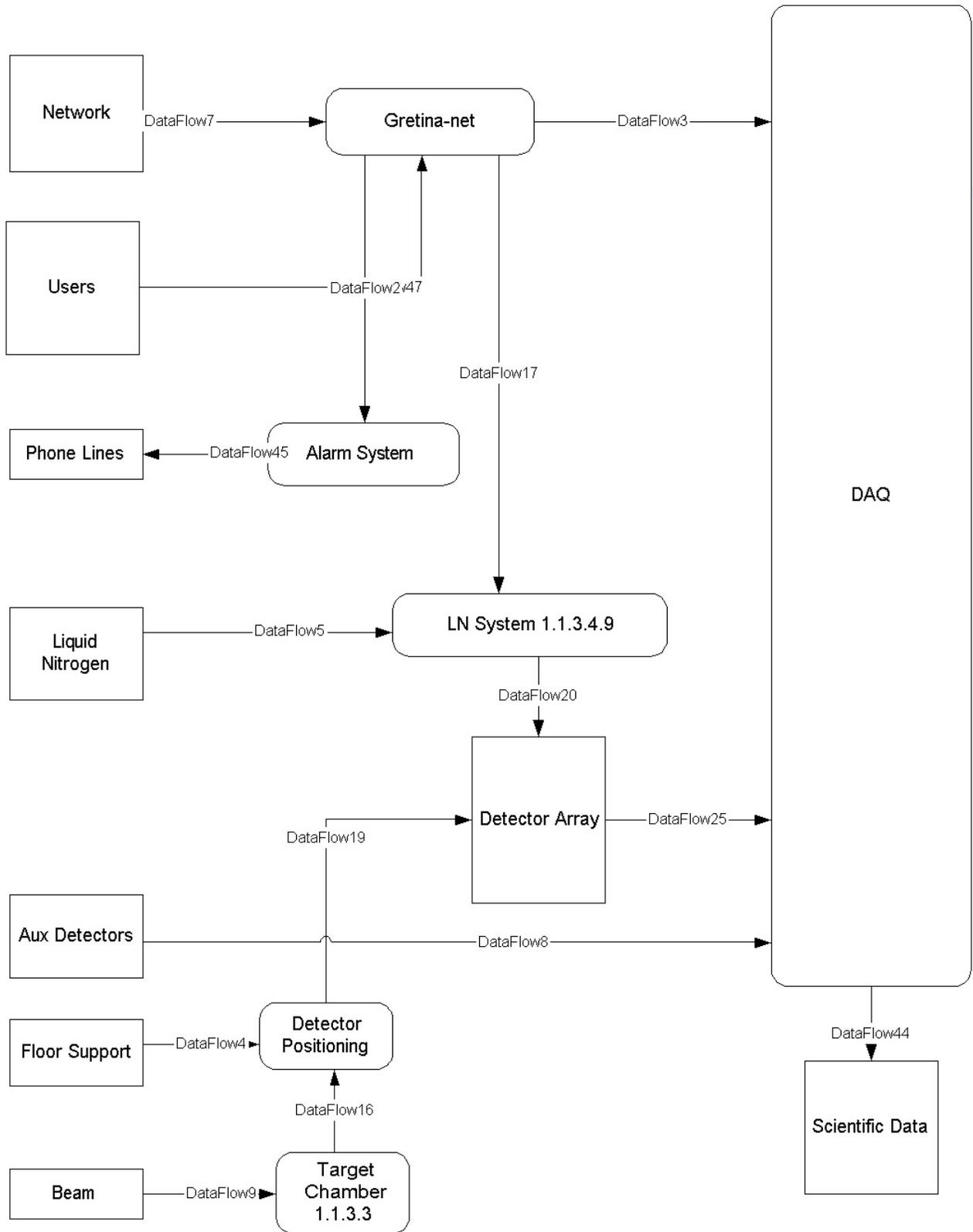


- Every system should provide an EPICS interface for monitoring and control
- EPICS databases, device supports and screens may be developed independently but interoperation is assured.

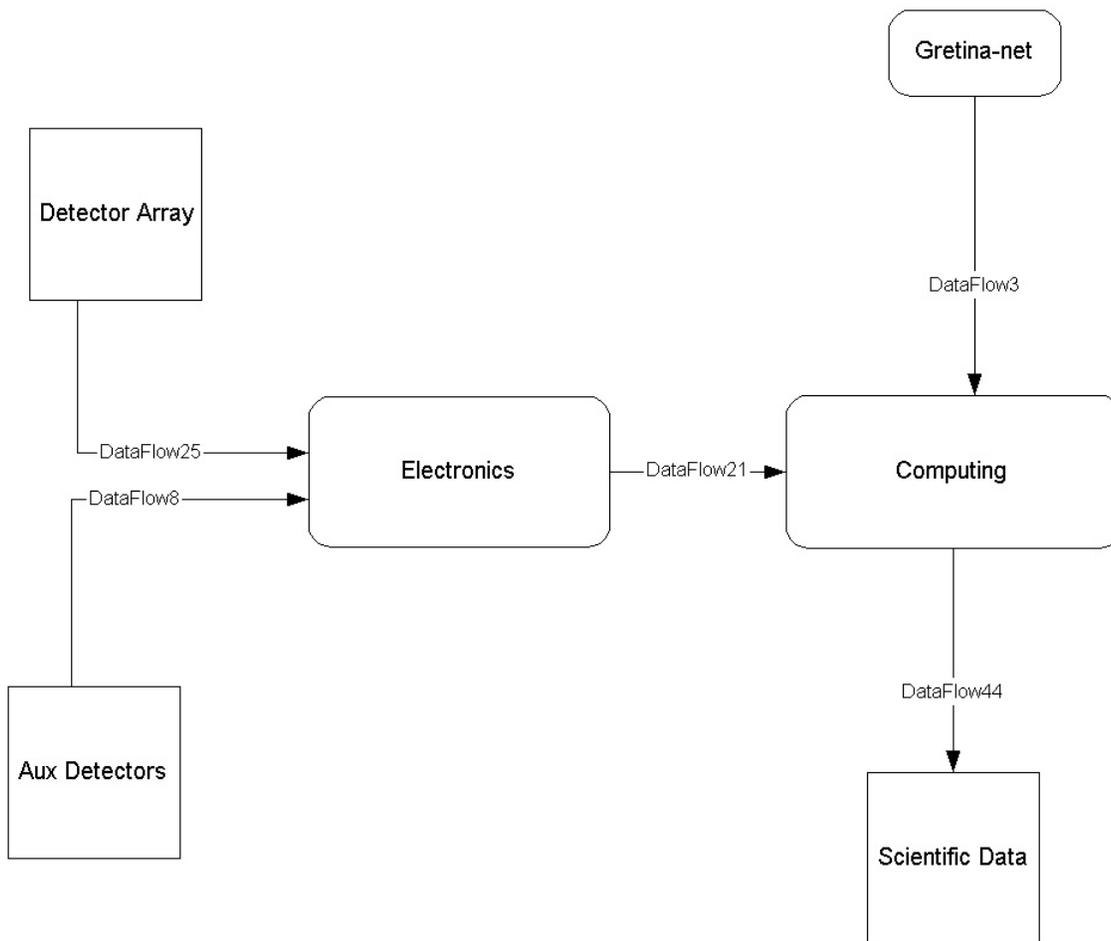
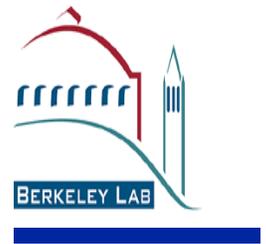
# Gretina Context



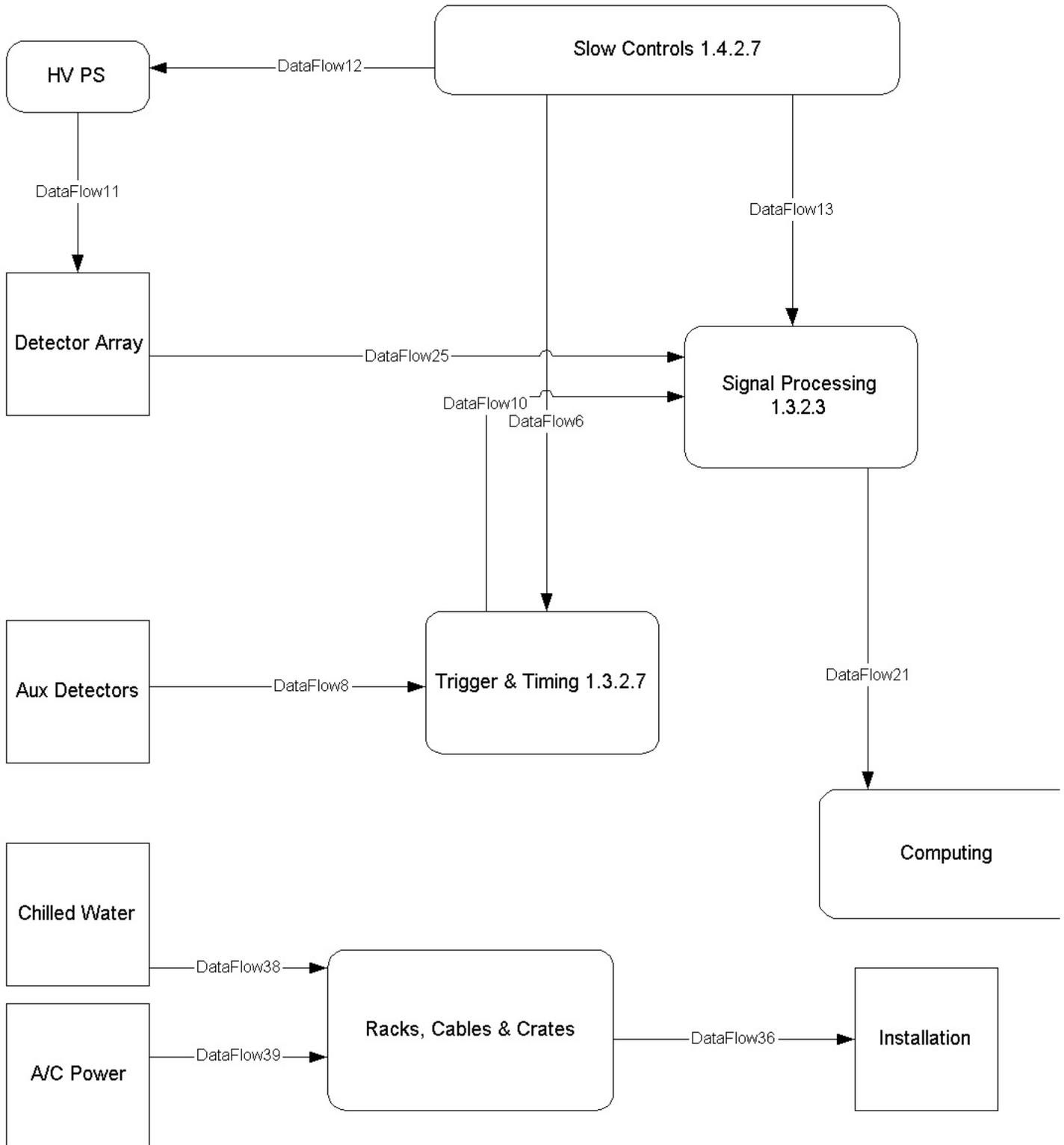
# Gretina



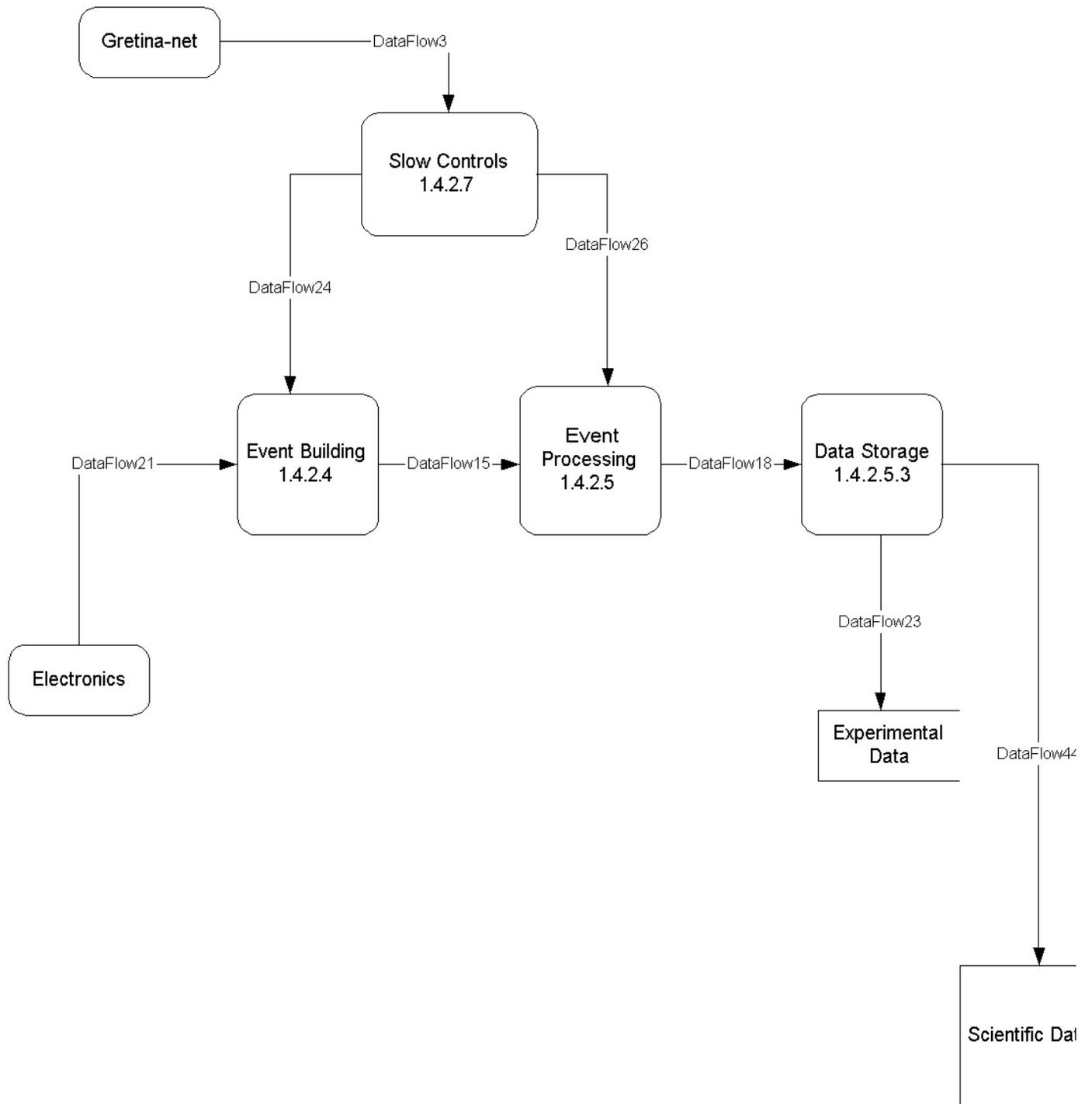
DAQ



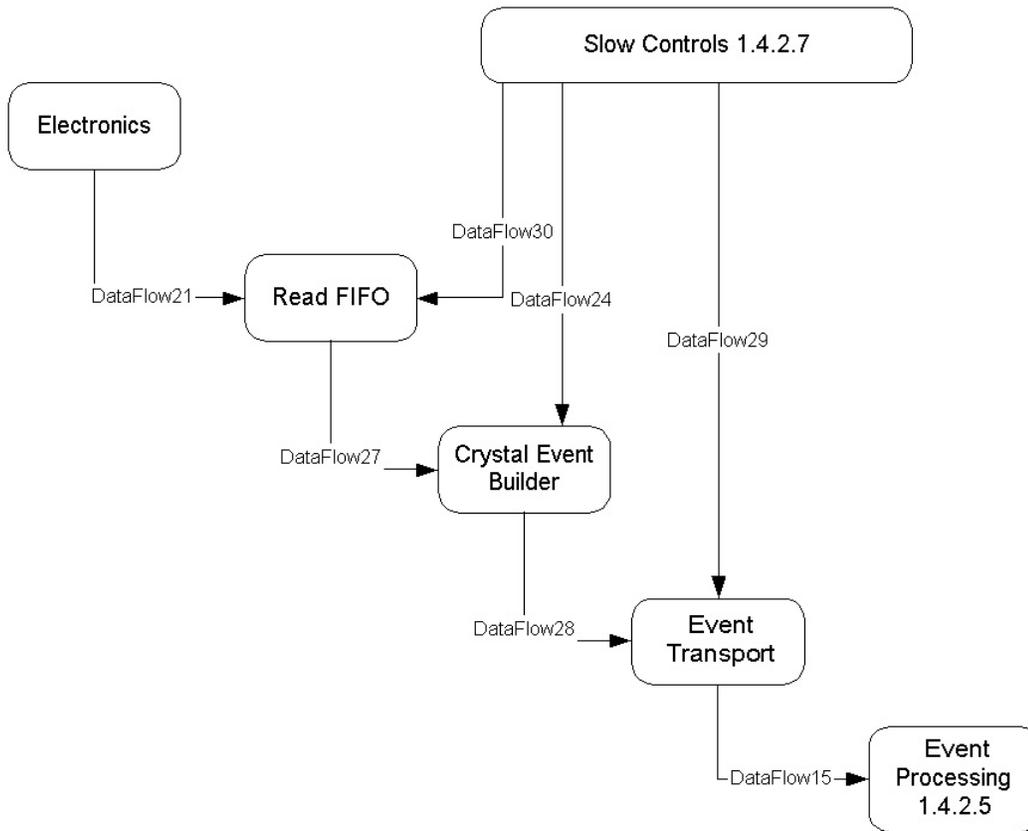
# Electronics DAQ.2



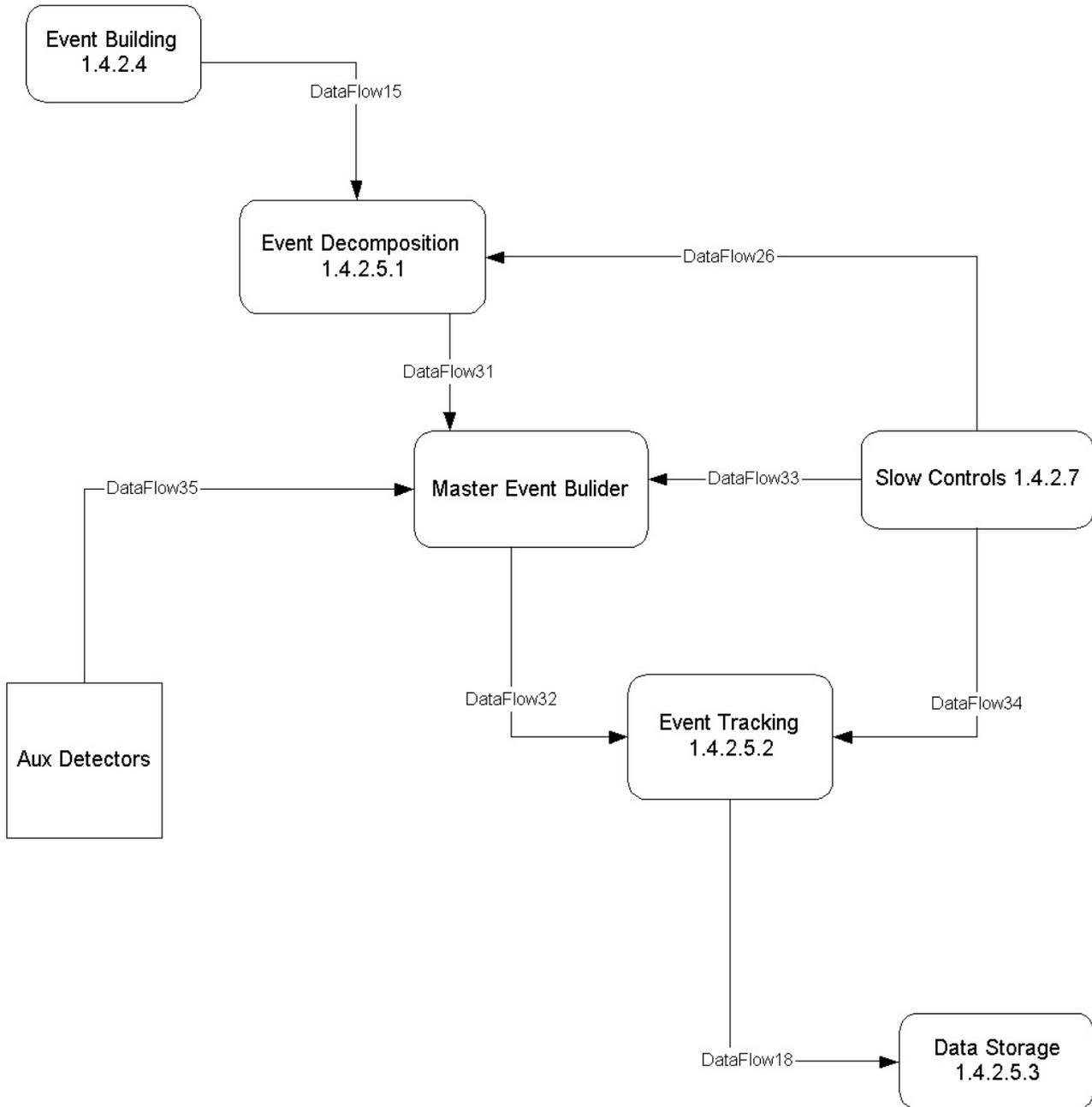
# Computing



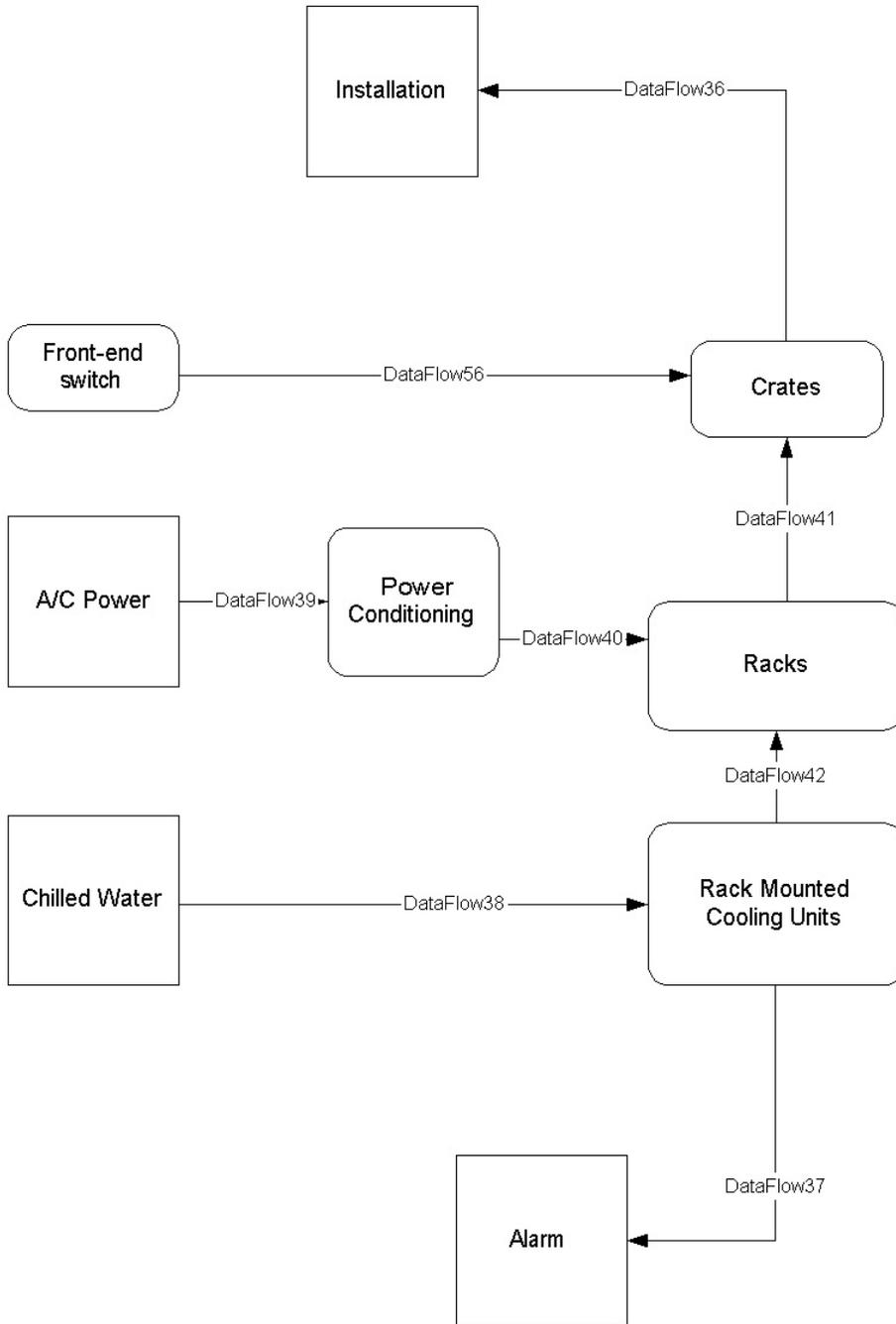
# Event Building



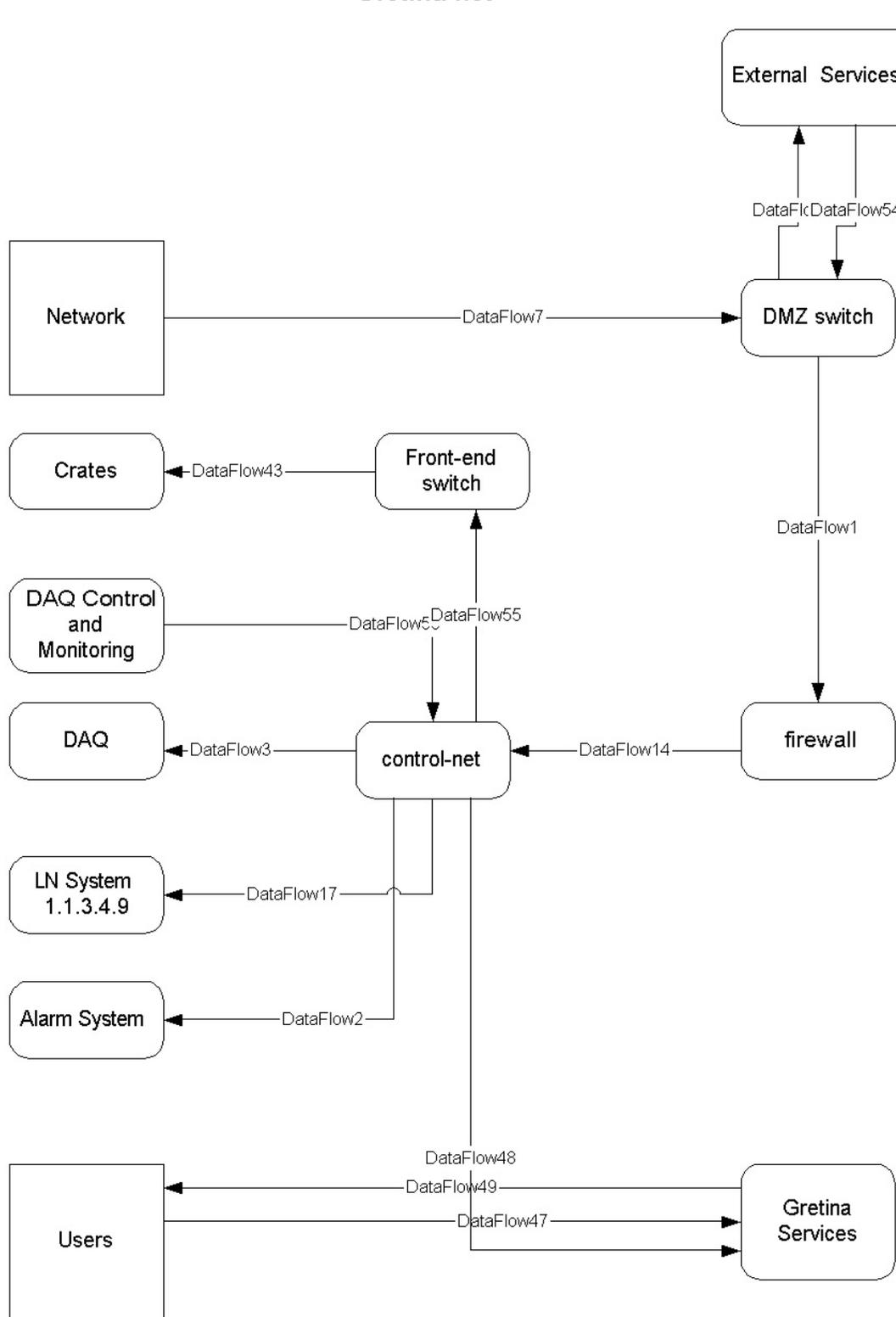
## Event Processing 1.4.2.5



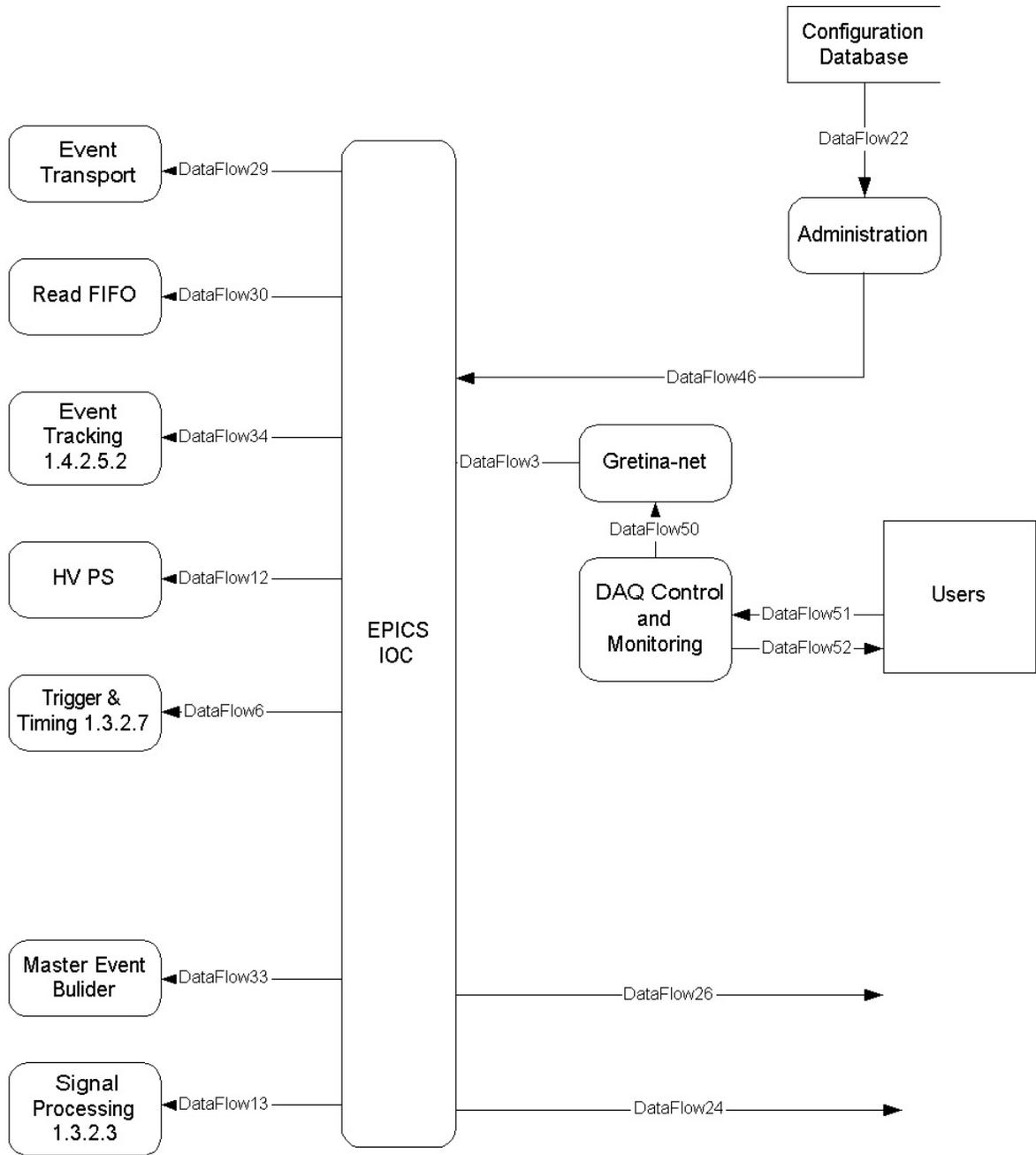
# Racks, cables and crates



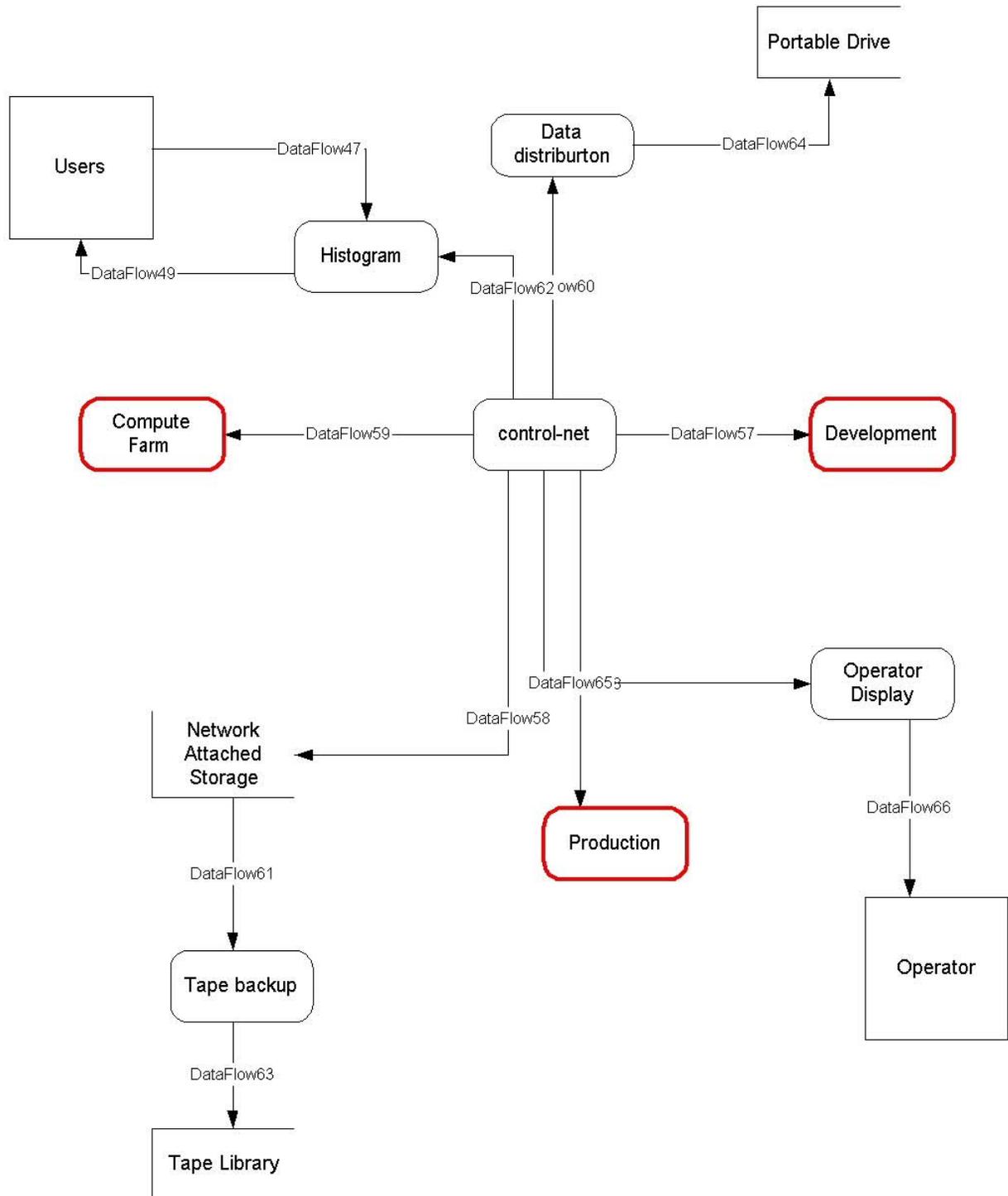
# Gretina-net



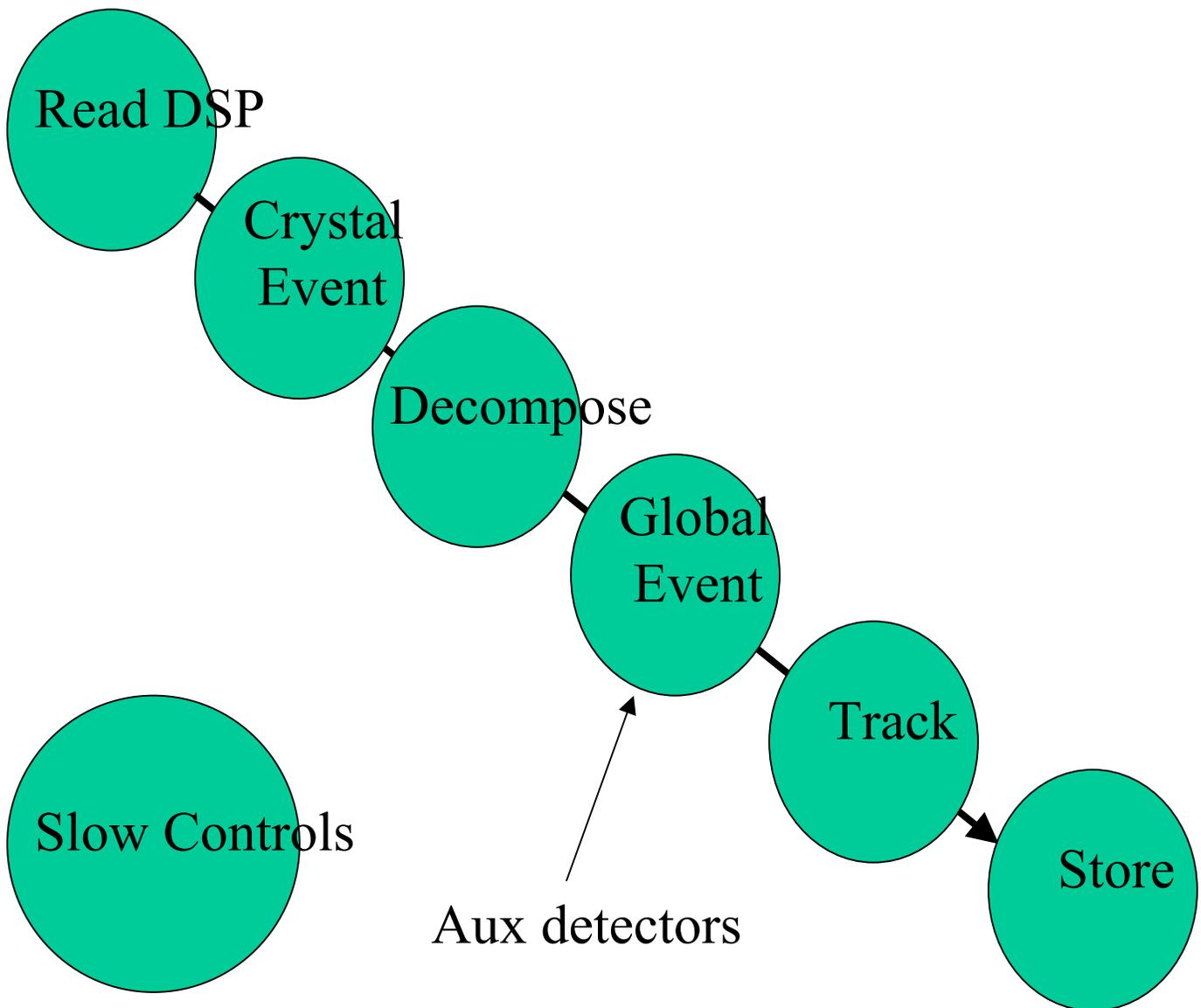
# Slow Controls



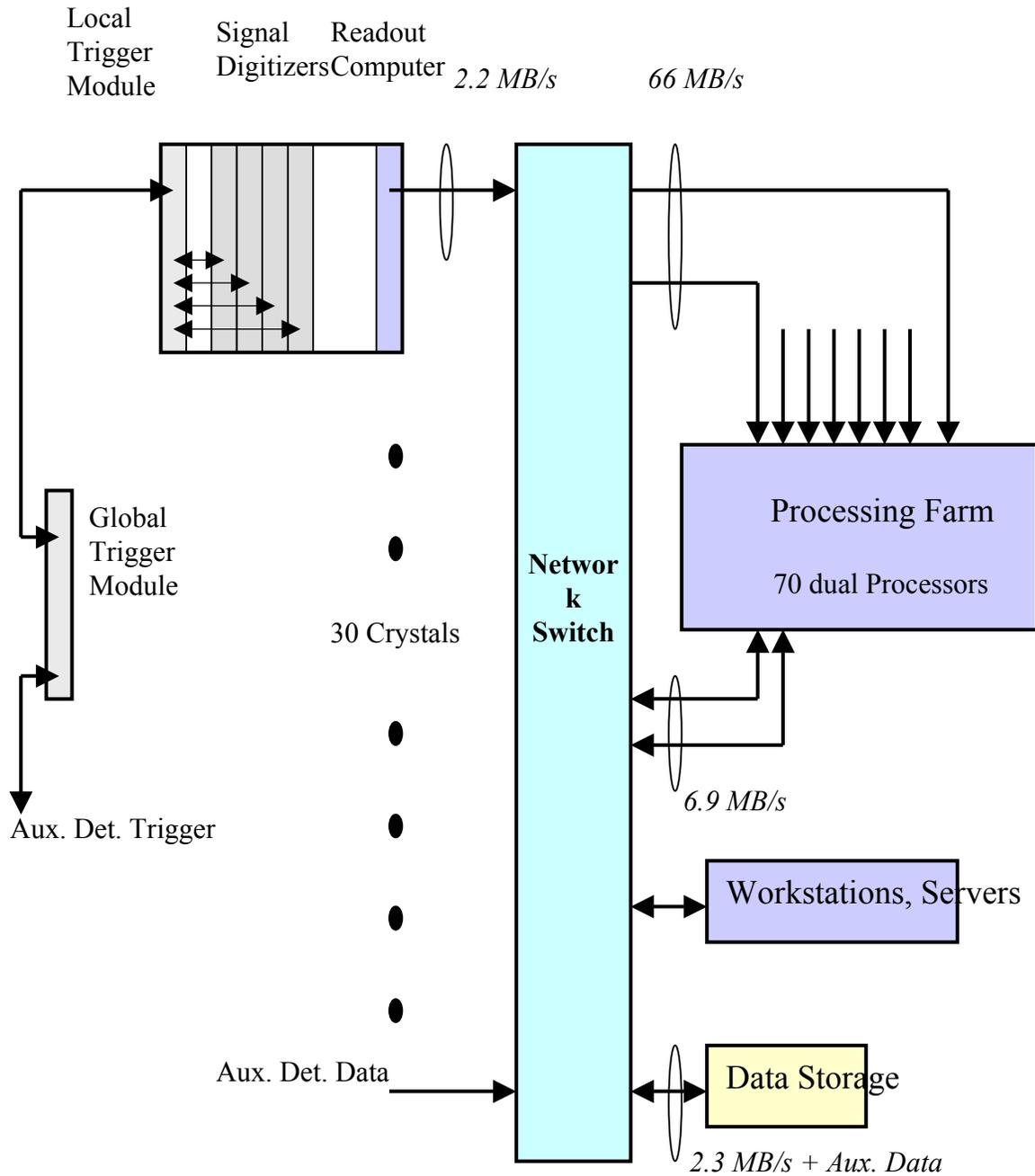
# Gretina Services



# Essential Dataflow



# Data Acquisition system



# Design Bandwidth



- Front End Bus Bandwidth (need 400MB/s)
  - $10 * 160 \text{ MB/s} * 50\% = 800 \text{ MB/s}$  (VME 64x)
- Readout CPU to Farm Bandwidth
  - $10 * \text{GigE} * 50\% = 600 \text{ MB/sec}$

# Readout Software



- The software that runs in the front-end computers
- Tasks
  - Read hardware
  - Crystal Event building
  - Transmit crystal events over network
  - Slow Controls

# Readout Slow Controls

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- Control Detector Settings
- Monitor Detector performance
- Control Data Flow
  - Trigger control?
  - Decimation algorithm?

# Conclusions



- EPICS will provide a unifying factor
- Relational databases will be used to keep track of configuration data