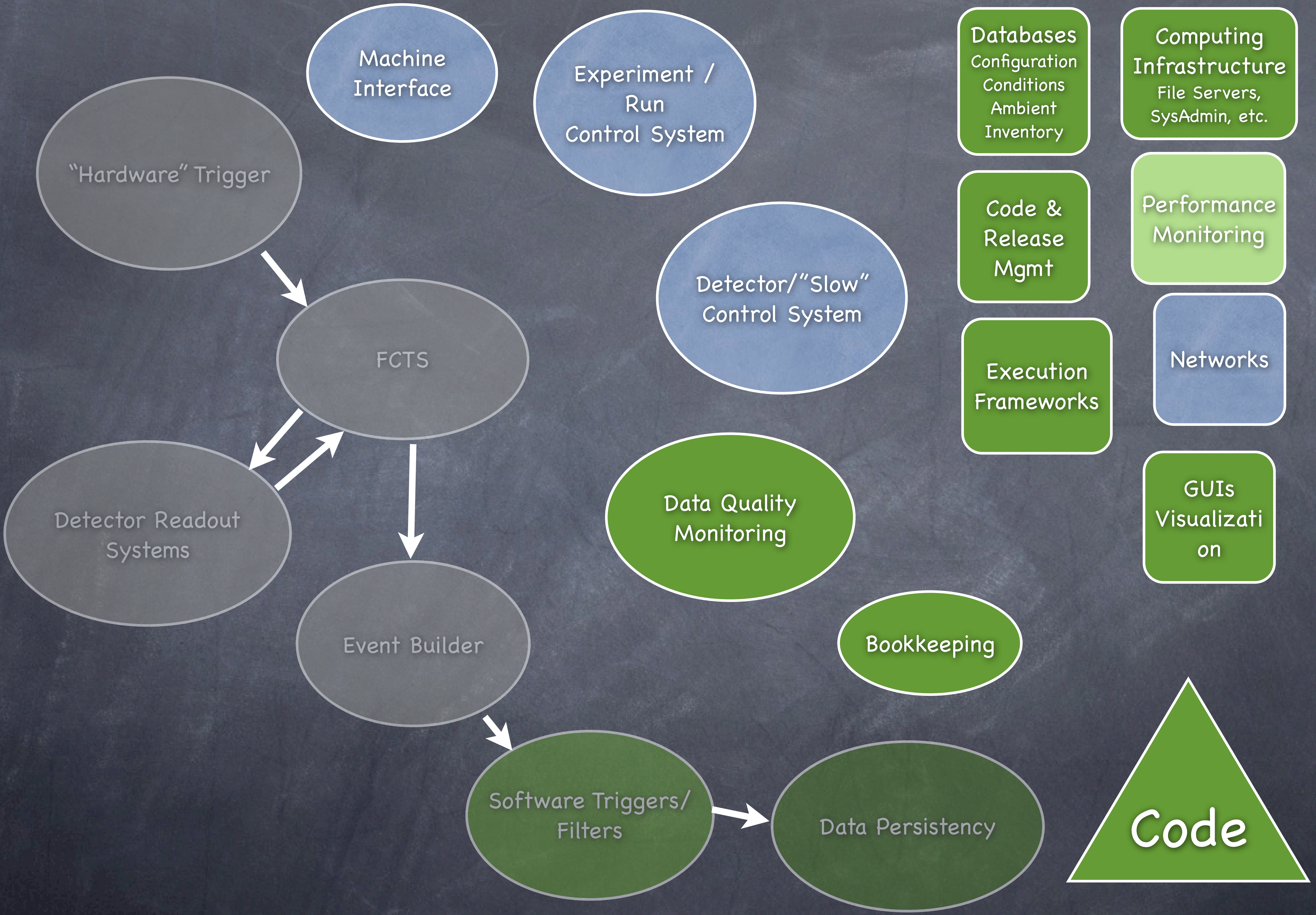
Offline / Online Connection

Steffen Luitz, SuperB Computing R&D Workshop, Ferrara, March 2010

From BaBar Experience Some Talking Points

- Components in Online
- Code Management, Release and Build System
- Data Format & Dependency Management
- Online vs. Offline Paradigms
- Shared Code
- Performance / Quality Control
- Bookkeeping



Machine Interface

Experiment / Run Control System

"Hardware" Trigger

FCTS

Detector/"Slow" Control System

Detector Readout Systems

Event Builder

Data Quality Monitoring

Bookkeeping

Software Triggers/ Filters

Data Persistency

Databases
Configuration
Conditions
Ambient
Inventory

Computing Infrastructure
File Servers, SysAdmin, etc.

Code & Release Mgmt

Performance Monitoring

Execution Frameworks

Networks

GUIs Visualizati on

Code

Code Management, Release+Build System (1)

- BaBar
  - "2 1/2" different release + build systems
    - Dataflow build system (embedded + regular)
    - "Online Releases" - RT (standard BaBar Software Release Tools) but special
    - Base SRT releases
  - Some of the Issues
    - Online usually fairly close to the head (driven by ongoing improvements)
    - Impractical code dependencies (Online on top of SRT Base) and complex dependency management (what goes where, etc.). Online, where you want most flexibility & agility depended on this huge blob of SRT base
    - Search path overlays can be dangerous
    - Several attempts to improve - never high priority
  - Opportunity for R&D in code organization
    - Code organization (peer modules) as well as runtime (dynamic loading)
    - Some ideas are already there

Code Management Release+Build System (2)

- Other areas of interest
  - Configurable firmware in more and more places (embedded processors, FPGA configurations, etc.)
    - Need to manage & track - What should be integrated with release mgmt?
  - Scripts, glue code, computer configurations
    - ditto
  - Especially Online needs to be able to "test" deploy and back out quickly
    - More automation than BaBar (path / symlink based scheme) seems desirable
    - With only O(100) HLT nodes in SuperB - tractable problem

Data Format + Dependency Mgmt (1)

- Data format (or semantics) or database schema changes are always difficult
  - Fundamental problem: Have to deploy code that understands the new format / schema before deploying code that produces data in that format
- Unfortunate effect in BaBar: Interesting improvements in Online got delayed for months because downstream release building and deployment was difficult
- SuperB: Attempt to design a system that provides the necessary agility and flexibility for Online
  - e.g. Simplify downstream release builds / deployment
  - e.g. look into how improved forward&backward compatibility could be achieved

Configuration Mgmt / "Provenance Light"

- Strict configuration management across the Online system is desirable - especially in places where data is permanently discarded (many places) - very limited in BaBar
  - Know and record the physical and logical configuration of "all" components to a reasonable level of detail
  - Ensure to a reasonable degree that the actual physical and logical configuration is what has been requested from the system. Take appropriate actions in case of deviations
  - "Provenance light" - understand what was going on after the fact
- Design mechanisms to ensure (and record) consistency of what code is running and how it is configured
  - Large farms - make sure every machine has the right executables and configuration. Interesting problem in the presence of multi-level caching.
  - Beneficial for offline processing - design a common system?
  - Support versioning of data and configurations for things you want to redo

Online / Offline Paradigms

- Boundaries between "Online" & "Offline" are becoming increasingly blurry.
  - Computers are getting much faster, so you can do much more "online"
  - Code sharing is very attractive
- Fundamental difference:

Online is where you (usually) can't redo things if something goes wrong!

Shared Code Thoughts from BaBar

- Lots of benefits from Online/Offline code sharing
- Online paradigms impact how code used by Online must behave - especially in areas of input validation and error handling:
    - Code used in Online often needs to be very robust against malformed input data. Alert and skip, not segfault & core dump. Impacts all code used in Online.
    - In Online systems assert() is not always your friend - code needs ability choose what to do in the face of errors. Exceptions (or similar mechanisms)
    - Need to propagate errors to higher levels where meaningful decisions can be made
    - Restarting from scratch "to reset" is not always acceptable, especially if startup times are long
- True code sharing requires some thought and reliability engineering

Performance & Quality Control

- When running in an Online context, code may run in or close to the "dead time path"
  - Careful engineering & testing
  - Take into account average & worst-case performance
  - Engineer frameworks that allow to deal with worst-case
    - e.g. "non-blocking" behavior where appropriate
- Overall performance
  - Ability to fully utilize underlying platform
    - Multithreading. GPU, other non-uniform architectures, etc.
- Quality control
  - verify code to standards outlined on this & previous slide

Bookkeeping & Storage

- Some thoughts
  - Establish Event-independence as early as possible
    - "linked" events in FE (for overlap & pile-up handling) - unlink in ROM
    - Event-independence in event builder highly desirable (temp grouping OK)
  - Do not introduce unnecessary serialization/choke points in the downstream system
    - such as e.g. merging run parts into complete run files in BaBar
  - Avoid format conversions / reformatting ("raw" data format)
  - Over the SuperB lifetime, storage media may significantly change in characteristics (e.g. Tape, Disk, SSD, ...)
    - Decouple file / container sizes from data grouping concepts such as "Runs"
    - Allow for optimization of file sizes - splitting, merging
  - Is a versioning capability for raw data (e.g. in case of "manual" repairs or removal of "bad" parts) needed?
    - I'm tempted to say no - forego the complexity and write-off the data
    - but then it may come for free from the downstream bookkeeping
- Bookkeeping system - shared between Online & Offline must hide the complexities from users (and apps)