CERN-EP R&D Initiative Software Working Group

Jakob Blomer and Graeme Stewart
ALICE Offline Week

2018-03-14

EP R&D Programme

- R&D programme on new Detector Technologies
  - Spans a 5-years period from 2020 onwards (with a possible extension by another 5 years)
  - Detector hardware, electronics and **software** for new experiments and detector upgrades beyond LHC phase II
- Working groups are for the key themes
  - To study the state of the art, limitations and main challenges
  - Define an **ambitious** and **focused** work programme with milestones, deliverables and resource estimates.
- Open Process
  - Interested colleagues - no matter if engineer or physicist, staff or user, at CERN or elsewhere - are invited to contribute to the definition of the R&D programme

Timeline

You Are Here

- 20 November 2017 - Kick off meeting
  https://indico.cern.ch/event/677108/

  Working groups form and start to develop first ideas

- 16 March 2018 - First Workshop
  https://indico.cern.ch/event/696066/

  WG meetings and preparation of their chapter

- October 2018 - Second Workshop
- November 2018 - Deliver final report

  Future funding will be based on this report

Software R&D Experience

- Previous R&D projects ran from 2007-2011
  - CERNVM and CVMFS
  - Concurrency
- Both these activities were a success
  - But they took many years to reach production
    - 10 years after the start we have production services, but continued refinement, development and adaption
    - We are not focused on HL-LHC startup, but benefits would come during HL-LHC running
- Key elements of success
  - Have something to show to users relatively early
  - Dedicated, but modest funding seems to work (π people)
    - This also fits with the anticipated level of support
  - This model seems to attract good people to the project

Software Working Group

- Outcome is a chapter proposing R&D projects for software that...
  - Align with the challenges faced by the whole HEP programme
  - Foster development of specific expertise in CERN
  - Are relevant for future project**s** (i.e., more than one experiment)
- Open scientific discussion started by lightning talk sessions
  - Two half-day sessions, total of 28 short talks presented and discussed: https://indico.cern.ch/event/699252 https://indico.cern.ch/event/702570/
  - Broad participation from both within and outwith EP and CERN
- A core group of experts was formed to review, aggregate and converge from the gathered inputs
  - Must be representative, but small enough to be agile and focused
    - Tries to cover all the domains and the experiment groups
  - Results of this group are communicated back to the mailing list and feedback from everyone is welcome

Working Group Core/Editing Team

- EP-RDET-WG7-Software-Core@cern.ch ⬅ if you would like to contact that group

Jakob Blomer (Convener)	Danilo Piparo (ROOT, Concurrency)
Graeme Stewart (Convener)	Witek Pokorski (Geant, Generators)
Marco Cattaneo (LHCb)	Radu Popescu (Other languages)
Dirk Duellmann (IT expertise and link)	André Sailer (CLiC, LCD)
Benedikt Hegner (FCC)	Andreas Salzburger (ATLAS, FCC, Tracking)
Mario Lassnig (ATLAS, Data Management)	Niko Neufeld (LHCb, DAQ, FPGAs)
Maurizio Pierini (CMS, Machine Learning)	David Rohr (ALICE, GPUs)
Helge Meinhard (IT R&D)	

Software Working Group (contd.)

- EP Department R&D Workshop 1
  - https://indico.cern.ch/event/696066/
  - Every working group has 45’ to present, *including discussion*
  - Our take on this is
    - 15’ (10+5) Introduction to software challenges (Graeme Stewart)
    - 10’ (5+5) Future tracking (Andy Salzburger)
    - 10’ (5+5) Machine learning solutions (Maurizio Pierini)
    - 10’ (5+5) Physics from an end-to-end system (Giulio Eulisse)
  - Selection of themes and subsequent coalescing inevitable
  - Aims at showing benefits of and needs for investing in software

- Between Workshop 1 (now) and Workshop 2 (autumn)
  - Core working group meetings and topical meetings to hammer out the software R&D report chapter

Lightning Talks: Selection of Topics

- Simulation for future experiments
- Reconstruction challenges for trackers and calorimeters
- New scalable analysis models
- Applied machine learning
- Tools for concurrency on heterogeneous resources
- Exabyte data flow and data management
- Support for new architectures
- Software integration
- ...

➜ See Friday presentations

EP Software R&D Group

- Mailing list
  - EP-RDET-WG7-Software@cern.ch
  - EP-RDET-WG7-Software-Core@cern.ch (core group)
- Sharepoint site
  - https://espace.cern.ch/ep-rdet-wg7-software/
- Indico
  - https://indico.cern.ch/category/10015/
- 16th March 1st Workshop (*this Friday!*)
  - https://indico.cern.ch/event/696066/

Backup

Questions and Inspiration!

- Physics motivation for a particular technology to be developed?
- New technologies might we be obliged to use in the future?
- A concrete piece of software that to be expected within 2 years?
- An educated guess about the potential of the technology in the next 5-10 years?
- Can we carry out the R&D work roughly within the current resource envelope?

HSF Community Roadmap

OpenLab white paper on future challenges

Software technology forum

Diana-HEP meetings

- HEP algorithm toolbox for computing accelerators
- Machine learning for analysis, fast simulation, I/O tuning; error estimation and predictable system behavior
- Turn-key systems for future experiments; framework modularization and ready-made analysis facilities
- High-level programming paradigms and abstractions; declarative programming, software correctness guarantees, domain-specific languages, etc.