Preparing Software for the Future
Introduction into Discussion

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Using input from AF members and HSF

What's ahead of us?

- **Increasing complexity and multiplicity of physics events** a challenge for simulation and reconstruction performance
- The free lunch is over (no news!) and we have to **actively address problems of SW performance**
- Have to re-learn many things due to **evolution of CPUs** and **new architectures arriving**
- Do not have the resources to evaluate every **new technology** in each experiment independently
- Have to **seek commonality and collaboration** in new developments resulting from the evaluations

⇒ Improve both on SW efficiency and efficient usage of people's time

Current Status and Activities

- **HEP Software Foundation (HSF) as the umbrella for addressing these problems together!**

- **Sharing expertise**
  - Schools, trainings and courses (not always easy to find), wikiToLearn
  - HEP S&C Knowledge Base
  - HSF Technical notes
  - Topical fora and working groups in HSF

- **New hardware architectures and technologies**
  - Concurrency forum
    - may need a second round of technology demonstrators!
  - Usage of resources provided by e.g. CERN's TechLab / Openlab
  - Porting efforts within the LHC experiments

Current Status and Activities II

- **Software performance and evolution**
  - Simulation: parallelisation of Geant4; GeantV
  - Reconstruction: HSF common tracking SW forum + Machine Learning Forum rather fresh
  - I/O: parallel ROOT I/O, key-value-store evaluations
  - Mathematics: MetaLibm
  - Ad-hoc improvements and parallelization in various SW projects
  - Performance tools (e.g. igprof, FOM tools)

- **Efficient development**
  - Often do avoidable work (reinventing the wheel within the community even!)
  - No good support in creating/discovering/using/maintaining software
  - Little knowledge of tools making developers' life easier
  - Quite some potential for improvement!

Cross-experiment collaborations

- **There are quite a few (more or less) new cross-experiment collaborations, with involvement or moderation of the HSF**

- **GaudiHive**
  - Parallelization of the Gaudi framework
  - Developed by ATLAS, LHCb, FCC

- **Common Conditions Data Project**
  - Discussed between ATLAS, Belle II, CMS and LHCb

- **Projects in the context of the AIDA and AIDA2020**
  - DD4hep for detector description (LCD, FCC, potentially LHCb)
  - PODIO (FCC, LCD, potentially LHCb)

- **Common Software Build and Packaging Tool efforts**
  - Working group of HSF comparing HEP and non-HEP solutions
  - Starting point was LCG's Librarians and Integrators Meeting

- **Cooperation on Reconstruction Software**
  - "Connecting the Dots" extended by session about common tracking implementations

For Discussion

- **Status of Technology Tracking**
  - Future HW architectures
  - New technologies/trends worth looking at
    (cloud based analysis, e.g. Data Mining-as-a-Service?)
  - Instrumentation and tools for measuring and improving SW performance
  - What else?
- **Evolution vs. Revolution**
  - Parallelism / vectorization implies revolutions in our SW
  - Challenge to backwards compatibility
  - Results of Revolution can still be included as evolution
    (GeantV's VecGeom as "preview" in Geant4 10.2)
- **Managing available manpower efficiently**
  - In the HSF vision we
    - build up more commonality in software projects and procedures
    - prepare a common curriculum of development essentials
    - provide an easy entry point for people to apply best practices
      (HSF project template + infrastructure to set up + tools)
    - improve on quality and ease-of-use of the software we develop
      (less incentive on reinventing the wheel!)

- **We have the HSF as the natural place to prepare for the future - let's take advantage of it!**
  - HSF workshop planned for May 2-4
  - We should contribute hands-on with our ideas!