IRIS-HEP Blueprint: Concepts and Process

Fast ML and Inference Blueprint Workshop September 10-11, 2019

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hep





The Pursuit of Particle Physics



To understand the the Universe at its most fundamental level

Primary questions: What are the
elementary constituents of matter?
forces that dictate their behavior?
fundamental nature of space & time?



LHC Experiments





LHC Experiments generate 50 PB/year of science data (during Run 2)



LHC Schedule







LHC as Exascale Science











Computational and Data Science Challenges of the High Luminosity Large Hadron Collider (HL-LHC) and other HEP experiments in the 2020s



The HL-LHC will produce exabytes of science data per year, with increased complexity: an average of 200 overlapping proton-proton collisions per event.

During the HL-LHC era, the ATLAS and CMS experiments will record ~10 times as much data from ~100 times as many collisions as were used to discover the Higgs boson (and at twice the energy).



→ Institute for Research and Innovation in Software for High-Energy Physics (IRIS-HEP)

IRIS-HEP resulted from a 2-year community-wide effort involving 18 workshops and 8 position papers, most notably a and . IRIS-HEP starting in Sept 2018.



The Blueprint Activity



Building Partnerships

The Blueprint Process

Partners . .

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9.1

9.2

- It was recognized early in the community process of developing IRIS-HEP that its success depends on an informed evolution of its activities, direction, and (possibly) structure
- It was suggested to formalize this into a Blueprint Activity that was written into the Strategic Plan submitted to the NSF



Strategic Plan for a Scientific Software Innovation Institute (S^2I^2) for High Energy Physics

Peter Elmer (Princeton University) Mark Neubauer (University of Illinois at Urbana-Champaign) Michael D. Sokoloff (University of Cincinnati)

April 6, 2018







 The *Blueprint activity* is used to inform the development and evolution of the IRIS-HEP strategic vision





The Blueprint Process



- A <u>series of workshops</u> that bring together IRIS-HEP team members, key stakeholders and domain experts from disciplines of importance to the Institute's mission
 - Topical presentations and breakout sessions
- Discussions are captured and they inform key outcomes which are summarized in a short report made publicly available

From the first IRIS-HEP Blueprint Workshop held at NYU (June 21-22, 2019):





The Blueprint Workshops



- Completed
 - Analysis Systems R&D on Scalable Platforms (June 21-22 at NYU)
- In progress
 - Accelerated Machine Learning and Inference (Sept 10-11 at Fermilab)
- Scheduled
 - <u>A Coordinated Ecosystem for HL-LHC Computing R&D</u> (Oct 23-25 at CUA)
- In the planning stage (Please <u>contact me</u> if you have more ideas!)
 - Training, Education & Workforce Development
 - Strengthening Connections between Theory & Experiment
 - Analysis Systems & Software Ecosystem
 - Intelligent & Accelerated Big Data Delivery
 - Analysis Preservation & Open Access Data



This Blueprint Workshop







This Blueprint Workshop



Major Goals

- Summarize the current status of R&D in the field
- Get informed by experts on the latest technologies
- Communicate and contrast the various technological choices available for both hardware trigger algorithms and heterogeneous computing with accelerated machine learning
- Build and educate the community for developing a wide range of accelerated ML use-cases
- Review the IRIS-HEP Milestones & Deliverables in Fast ML and plan for Y2 / 18-month review

Desired Outcomes & Deliverables

- Develop a roadmap of hardware trigger applications to pursue from near term to blue sky
- Develop a roadmap of accelerated machine learning computing applications from near term to blue sky
- Establish a hardware demonstration platform work plan at multiple sites
- Establish partners for possibilities for connecting with use-cases outside of LHC
- Generate a Blueprint report summarizing the workshop goals, activities and key findings 12