Snowmass2013

Community Summer Study

Computing Frontier Study Group

LATBauerdick/Fermilab

Charge

- Computing has become essential to advances in experimental and many areas of theoretical physics. Research requirements in these areas have led to advances in computational capabilities. The participants in the Computing Frontier will address these issues:
  - ★ What are the computational requirements for carrying out the experiments that will lead to advances in our physics understanding?
  - ★ What are the computational requirements for theoretical computations and simulations that will lead to advances in our physics understanding?
  - ★ What facility and software infrastructure must be in place in order to meet these requirements, and what research investments does it require in computing, storage, networking, application frameworks, algorithms, programming, etc. to provide that infrastructure?
  - ★ What are the training requirements to assure that personnel are available to meet the needs?

Organization (I)

- Subgroups for “user needs”
  - Each subgroup to interact with the corresponding physics frontiers to assess the computing needs to advance the science
    - CpF E1 Cosmic Frontier
      - Alex Szalay (Johns Hopkins), Andrew Connolly (U Washington)
    - CpF E2 Energy Frontier
      - Ian Fisk (Fermilab), Jim Shank (Boston University)
    - CpF E3 Intensity Frontier
      - Brian Rebel (Fermilab), Mayly Sanchez (Iowa State), Stephen Wolbers (Fermilab)
    - CpF T1 Accelerator Science
      - Estelle Cormier (Tech-X), Panagiotis Spentzouris (FNAL); Chan Joshi (UCLA)
    - CpF T2 Astrophysics and Cosmology
      - Salman Habib (Chicago), Anthony Mezzacappa (ORNL); George Fuller (UCSD)
    - CpF T3 Lattice Field Theory
      - Thomas Blum (UConn), Ruth Van de Water (FNAL); Don Holmgren (FNAL)
    - CpF T4 Perturbative QCD
      - Stefan Hoeche (SLAC), Laura Reina (FSU); Markus Wobisch (Louisiana Tech)

Organization (II)

- Subgroups for “infrastructure”
  - The infrastructure groups are supposed to project computing capabilities into the future and see how the user needs map onto the trends.
  - If the trends indicate that research is needed to meet some computing needs, we will point that out to the funding agencies.
    - CpF I2 Distributed Computing and Facility Infrastructures
      - Ken Bloom (U.Nebraska/Lincoln), Sudip Dosanjh (LBL), Richard Gerber (LBL)
    - CpF I3 Networking
      - Gregory Bell (LBNL), Michael Ernst (BNL)
    - CpF I4 Software Development, Personnel, Training
      - David Brown (LBL), Peter Elmer (Princeton U.); Ruth Pordes (Fermilab)
    - CpF I5 Data Management and Storage
      - Michelle Butler (NCSA) Richard Mount (SLAC); Mike Hildreth (Notre Dame U.)

Computing is at a good Starting Point for Moving into the HEP Future

- We have established and well-working computing models
  - the different frontiers are at some level separate in terms of facilities
    - but we are identifying many commonalities in terms problems and approaches
  - by coming together we will map out a way to go forward
    - some level of cross-fertilization e.g. b/w the HPC and HTC folks already happening
- start using new technologies and approaches that are transformative
  - like parallelization and multi-core, virtualization, GPUs etc
  - for sure we'll see things over the coming years we have not yet thought of
- industry caught up to us and in cases surpassed us
  - might reassure us that with hard work computing won't be a road block
- a roadmap how to best support science from the view of computing
  - assess the individual needs of different frontiers
  - identify commonalities and differences
    - where it makes sense to share facilities or grids/clouds/etc. and where dedicated installations are needed, and how all can be used efficiently together
  - look at how industry can help and when this becomes feasible

Some of the talking points being discussed in the "Infrastructure" groups

- ★ HEP has large experience in both Distributed High-Throughput computing (experiment program) and High-Performance computing (mostly theory/ simulation/modeling)
- ★ we are good at "collecting together" compute resources from where ever we can get them — how about storage and data management?
- ★ emerging network capabilities and data access technologies improve our ability to use resources independent of location, over the network
- ★ enables a large spectrum of provisioning resources: dedicated facilities, universities, opportunistic use, commercial clouds, leadership-class HPC,...
  - ✦ funding and allocation models: PI/allocation oriented vs research community oriented
  - ✦ supporting IT infrastructure provided by HPC center or labs, and those provided by "consortium" of collaborating institutions like OSG
  - ✦ emerging experiment programs might consider a mix to fulfill demands
- ★ with the need for more parallelization the complexity of systems continues to increase: frameworks, workload management, physics code,
- ★ we are developing the list of issues to be addressed
  - ✦ also including maintenance of software libraries, data preservation, ...

CpF Activities

- Participate in Snowmass physics frontier meetings and gather input
  - ★ kick-off at CPM meeting last October at Fermilab
  - ★ more recently: Cosmic Frontier mtg at SLAC, Energy Frontier mtg at BNL, next week's Intensity Frontier mtg at ANL
  - ★ proactively collect requirements documents, run surveys, interact with the "computing coordinators" of different areas
- Infrastructure subgroups: discuss and assess computing future for HEP
  - ★ NERSC workshop to gather requirements and thoughts from the HPC scene
  - ★ Networking workshop at CERN
  - ★ Open Science Grid meeting to discuss and brainstorm on future needs for the High-throughput computing/Grid/Cloud use cases
  - ★ input from "community events" like the Snowmass mtgs (CPM, EF, CF etc), from recent DOE "summits", etc
  - ★ set of targeted discussions in the CpF I4 group on software, new architectures, workforce development and training etc
  - ★ need to catch up on CpF I5/data; data preservation aspect is in good hands
- Goal: be ready in advance for the Snowmass-on-the-Mississippi mtg
  - ★ subgroups prepare reports, to be summarized in a ~30 page document

Please help and participate!

- Community input and any type of help most welcome!
  - ★ Contacting the sub-conveners/conveners
    - http://www.snowmass2013.org/tiki-index.php?page=Computing+Frontier
  - ★ providing white papers
  - ★ help formulating the talking points etc for the sub-group reports
  - ★ come to the frontier meetings and discuss with the sub-conveners
  - ★ come to the Snowmass-on-the-Mississippi meeting at Minneapolis, 7/29 - 8/6 2013
- Particular areas of interest
  - ★ data management, storage and data access
  - ★ software, library, computing know-how and workforce
  - ★ new architectures and impact on software and infrastructure
  - ★ dark-matter/energy experimental program
    - follow Amber's advice to include it in the CpF E3/Intensity Frontier assessment
- your ideas and engagement are most welcome