Resources for scientific computing

Organizational
- supercomputers
- clusters
- grids
- clouds

Consumer
- desktop/laptop
- video game consoles
- smartphones, tablets
- appliances
- Internet
Performance potential

- 1 billion desktop/laptop PCs
  - CPUs: 10 ExaFLOPS
  - GPUs: 1,000 ExaFLOPS
- 5 billion smartphones
  - CPUs: 20 ExaFLOPS
  - GPUs: 1,500 ExaFLOPS
BOINC: middleware for volunteer computing

- Open-source, NSF-funded since 2002
- Server: distributes jobs, provides web site
- Client: runs jobs on consumer devices
- BOINC deals with
  - invisibility
  - device heterogeneity
  - recovery from random and malicious faults
Cost

Cost of 1 TFLOPS/year

- CPU cluster: $1.5M
- Amazon EC2: $4.5M
- BOINC: $0.1M

(cost in millions of dollars)
The original BOINC model

- Scientists create BOINC projects, compete for volunteers
- Volunteers evaluate projects, participate in the “best” ones
Projects using BOINC

- Climateprediction.net
- Rosetta@home
- Einstein@home
- IBM World Community Grid
- CERN
- . . .
Volunteer computing today

- 500,000 active computers
  - 2.3 million CPU cores
  - 290K GPUs
- 40 projects
- 90 PetaFLOPS
Problems and limitations

- The set of projects is small and static
  - creating a BOINC project is hard
  - risk: what if no volunteers?
  - not useful for sporadic or one-time workload

- The set of volunteers is declining
  - project lock-in
  - Marketing/branding
A new “coordinated” model for VC

Goals

- Serve more scientists
- Get more volunteers
- Move VC toward the mainstream of
  - HPC computational science
  - computer science
The model

- **Scientists**
  - add VC to existing HPC facilities like science gateways and supercomputer centers
  - prototypes: TACC, nanoHUB

- **The coordinator**
  - an interface to VC based on science goals rather than projects
  - a unified brand
  - an allocator of computing power to projects
Adding VC to existing HTC systems

- Application packaging
  - VirtualBox, Docker
- Remote job submission and file management
  - Web RPC interfaces
Onboard: a VC coordinator

- Volunteers pick science areas rather than projects.
- A resource allocation mechanism
  - XSEDE-based model
  - Projects no longer have to do PR
- A unified brand for marketing VC
Project status

- Funded 2016-2019
- TACC, nanoHUB
  - app packaging, job routing: done
  - public launch Q4
- Onboard
  - mostly done; Q4 launch
Interested?

- If your gateway could use lots of computing
  - high throughput/latency
  - large compute-intensive jobs

... then let’s talk!

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