I2U2
Grid Computing in the High School Classroom

For the collaboration:
Ben Clifford, Thomas Jordan
An NSF-funded collaboration
Constituent members:
An NSF-funded collaboration

Goals:

- Create a platform for 21st Century Science
- Provide a framework for science experiments to focus and encourage E & O efforts
- Utilize “the grid” to:
  - Increase compute power
  - Increase collaboration
  - Provide access to huge datasets
  - (Uses range from compute resources to meta-data)
The vehicle to do this:

e-Labs and i-Labs

They allow:

- Data sharing

- Workflow management

- “Publishing” of results

- Discovery of others’ data products

- Access to “canned” analysis recipes
Existing e-Labs:

Production:
- Cosmic Rays
  Access to data from nearly 100 classroom detectors
  > 9000 “detector days” of data (flat “raw” files)
  > 200 user accounts many with data uploads

Pre-production:
- CMS (Calorimetry test beam)
- AMELIA (ATLAS event reconstruction)
- LIGO (Access to environmental monitors)
- STAR (RHIC experiment event reconstruction)
e-Labs support:  

Data Search and Selection:

Choose data for the lifetime study.

DoE/University
Federal Way, WA
963 data files: 0 blessed, 0 stacked, 41,442,688 total events.

Federal Way Public Academy
Federal Way, WA
37 data files: 0 blessed, 0 stacked, 1,656,652 total events.

Garfield High School
Seattle, WA
227 data files: 0 blessed, 48 stacked, 7,372,981 total events.

Issaquah High School
Issaquah, WA
58 data files: 0 blessed, 0 stacked, 1,021,658 total events.

Results 1 - 10 of 12 for 12 Schools WA (searched 2629 files in 34.994 seconds)

Help
Tutorial on lifetime study
Step-by-Step Instructions
States include provinces and countries. Enter the abbreviation.

Legend
Unstacked data
Stacked data
Blessed data
Add/View comments

ISGC 2007
B. Clifford, T. Jordan
e-Labs support:
Workflow management:

B. Clifford, T. Jordan

ISGC 2007
e-Labs support:
Workflow management:

```cpp
TR Quarknet.Cosmic::LifetimeStudy(
   inout combineOut,
   none detector,
   none extraFun_alpha_guess,
   none extraFun_alpha_variate,
   none extraFun_constant_guess,
   none extraFun_constant_variate)
```

Directed Acyclic Graph
for LifeTime Analysis
input files
transformations
output file
temp files

B. Clifford, T. Jordan
ISGC 2007
e-Labs support:
Workflow management:
e-Labs support:
Catalogue of Derived Data:

Search for and view plots.

Show plots by: IL - Jordan - Fermilab - Batavia - IL - Everyone

or Search Plots by

States include provinces and foreign countries. Enter the abbreviation.
(Optional) Limit search by creation date:
Date: 1/1/2004 to 12/30/2050
e-Labs support:
Re-run an Analysis:

Flux Study

Data: Feb 28, 2007 6:00 CMT
Detector: 5100
Channel: 1

flux (events/m^2 / 100-seconds)

Time (QMT hours)
e-Labs support: Data Provenance:

B. Clifford, T. Jordan

ISGC 2007
An Experiment to Measure the Rate of Small Showers
6 Detectors in One Building—FNAL’s Kuhn Barn

03/11/2005
Thomas Jordan

Abstract
We arranged six readouts (DAQs or detectors) from several area schools and 23 scintillators in a grid that was about 10 meters square. We evenly spaced the detectors inside this square and collected data for nearly 16 hours. We expected to see more events with coincidences between readouts in this small arrangement as the primaries that create small showers are much more frequent than those that make huge showers.

Results
I only show the most energetic showers here. There are many more results to come from these data but on three occasions, we observed events that triggered at least two readouts with more than 10 signals in less than 100 ns. The first two that I show triggered on three readouts!

It would be interesting for someone to study how the number of signals varies over different trigger gates or how the number of events depends on the setting of the counter threshold.

- Figure 1: An event that triggered three readout boards (10 particles).
- Figure 2: An event that triggered three readout boards (10 particles).
- Figure 3: An event that triggered two readout boards (12 particles).

Discussions & Conclusions
This early analysis indicates the arrangement of 6 detectors into a small footprint worked. We observed 3 events (gate = 100 ns) with more than 10 particles in each event.

There are many more events in the data than what we show here. Look for those with fewer particles or shorter gates. Further questions can include:
- How many 3 particle showers occurred?
- How many of these events triggered 2 readouts?
- How many of these events are <50 ns? 80?

Procedures
We collected readout boards from Alan Shepard High School, Providence West High School, University of Illinois--Chicago as well as a few from Fermilab. We set up the experiment in Fermilab’s Kuhn barn to avoid the snow and ice. (We also wanted to stay warm!)

Setup included: installing GPS, arranging counters, connecting readouts and cabling to the computers.

We set the coincidence trigger on each readout board to twofold. This is to remove some of the "background" caused by simple, uncorrelated muons. We are most interested in showers here so we decided to ignore those.
e-Labs support:
Student Logbooks:

Logbook Entry for Group "anthro"

- Click to add a logbook entry.
- Click to view your teacher’s comments.

Comments: Number of teacher comments (number unread). New comments by your teacher are marked as 📝.

Research Basics

**simple measurements** - Notes on simple measurements

- 01/06/2005 04:11 I find it hard to use meters instead of inches.
- 12/15/2004 01:50 I wonder why this is called "simple". It doesn't seem so.
  - comments: 3
- 12/15/2004 10:34 Try for more.
  - 12/15/2004 10:06 Should I be using metric units for this? Yes I think I should. In fact, I should forget about the units I am use to.
  - comments: 3
- 12/07/2004 06:45 I am trying to figure out how to convert my geometry to the right units.
- 11/30/2004 08:50 Let's see if we can get a different time.
  - comments: 3
- 11/30/2004 08:48 I will also try to get use to the energy units.
- 11/30/2004 08:48 It is hard to get use to using the units of time.
  - comments: 3
e-Labs Infrastructure:

- SQL database for user database (paths/to/derived/data, logbooks, etc.)
- Java beans for form validation and job origination
- Tomcat webserver
- VDS workflow management
e-Labs Infrastructure:

- Cosmic Ray e-Lab Data Analysis
  - Each DAG node is a smallish perl script
  - Intermediate data files are input for the next node
  - Analyses are pre-defined workflows

- CMS e-Lab uses ROOT for the analysis routines
  - Tomcat interface to ROOT
  - Working to create SWIFT interface to ROOT

- Nearly 300 users (mostly in US High Schools)
- $10^3$ saved data products
- $10^5$ derived data products (18 months)
e-Labs Support:

- Fermilab Education Office
  - Marge Bardeen
  - Bob Peterson
  - Liz Quigg

- University of Chicago/Argonne National Lab
  - Ben Clifford
  - Mihael Hategan
  - Tibi Stef-Praun
  - Mike Wilde

- University of Florida
  - Tom Jordan

- University of Notre Dame
  - Tom Loughran
Summary

- e-Labs use the VDS API to allow students access to data and pre-defined analysis workflows.
- Computes run on a smallish cluster at Argonne National Laboratory.
- We have executed some jobs on OSG compute resources but have not put this in production.
- We have users!
- We are developing an e-Lab interface for ROOT.
- Supporting end-users is a DC effort.