Needs Assessment and Developers Workshop for Grid Techniques in Introductory Physics Classroom Projects

Florida International University
January 29 & 30, 2004

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Table of Contents

Developers Workshop Summary 1
Needs Assessment Workshop Summary 4
Appendix A: Needs Assessment Workshop Agenda 5
Appendix B: Developers Workshop Agenda 6
Appendix C: Needs Assessment Workshop Notes 7
Appendix D: Developers Workshop Notes 12
Appendix E: Technology Infrastructure & Access Survey Instrument 15
Appendix F: Technology Infrastructure & Access Survey Results 17

Sponsored By:
CHEPREO
Fermilab Computing Division
GriPhyN/iVDGL Education and Outreach
US CMS

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Developers Workshop for Grid Techniques in Introductory Physics Classroom Projects

Held on January 30, 2004 at Florida International University

PRESENT

ATLAS	Michael Barnett	**LIGO**	Fred Raab
CMS	Randy Ruchti	**QuarkNet**	Pat Mooney
			Lynda Rose
DØ	Greg Snow	**SDSS (VERITAS)/NVO**	Mark SubbaRao
Fermilab Computing	Liz Quigg		
Fermilab QuarkNet	Marge Bardeen	**Technology Educator**	Elisabeth Roberts
iVDGL/GriPhyN	Laird Kramer	**Facilitator**	Edward Moyer, Jr.
	Danuta Mogilska		
	Soma Mukherjee		
	Mike Wilde		

UNABLE TO ATTEND

BTeV	Joel Butler	**iVDGL/GriPhyN**	Paul Avery
Fermilab Computing	Ruth Pordes	**JLab**	Jan Tyler
Fermilab Run II	Jae Yu	**PPPL**	Andrew Post Zwicker
General Atomics	Pat Winter	**VERITAS**	Lucy Fortson

Background

Scientists and computer scientists are “keen” on Grids because they believe the use of Grids will transform the practice of their science. Grids are a tool for sharing the costs and burdens of immense computing needs and supporting the participation of scientists worldwide in large collaborations in particle physics, astronomy, cosmology, fusion and nuclear physics. Grids have the potential to change how people work together to make scientific discoveries. Can Grids make a difference in how students and teachers work together to learn science? The potential of using Grid tools and techniques for education is, in part, to provide access to shared data, analysis tools, and scientific findings, and to support enhanced peer–to–peer collaboration.

Educators, scientists and computer scientists used information gathered from a needs assessment to discuss:

- The nature of educators' interest in classroom investigations that use real physics datasets.
- Recommendations for project characteristics that would assist educators to integrate such projects into their courses.
- Implications on the design and implementation of Grid tools and techniques in science education.

This is an optimal time for educators and researchers to come together to shape the direction of this resource development. Building quality Grid resources for introductory physics students and teachers strengthens the case for further development of the infrastructure for such Grids. The discussion and development generated at this meeting builds upon individual efforts while developing a shared vision. This grass–roots effort, built collaboratively from shared resources and tools, allows us to construct something greater than any single project could accomplish in isolation. By taking the lead in this effort, we shape what it could become.

Summary and Next Steps

Educators’ Interests

Teachers are interested in and excited about the potential that Grid tools and techniques bring to data–based classroom projects. To use the Grid, teachers need a user–friendly site where inquiry–based projects are standards–based, visually appealing, use common tools and data formats, allow for levels and scale of use, and provide support materials for teachers and students. A well–conceived and

delivered professional development program must accompany the online resources. Some teachers will come to the projects as experienced users with a great deal of knowledge about the research and experience with inquiry–based learning using online resources. Others will be emerging or beginning users. Most classroom users will analyze data from the web tools. Some will be interested in learning "what's under the hood," exploring Grid portals, and a few will become developers of Grid skins or transforms. (Complete notes in Appendix C.)

Educators' Technology Infrastructure and Access

Teachers in attendance at the Needs Assessment workshop completed a survey (see Appendix E) about the type of technology infrastructure and the level of available access at their home institution. Questions were clustered into the following groups:

- Operating system
- Internet browsers available
- Computer or network capabilities
- Enrollment numbers (total and number possibly involved in Grid–based projects)
- Computer access locations and numbers
- Policy implications (according to level of projected use)
- Involvement of others (user and developer levels)

In general, the teachers at the workshop currently have the capabilities necessary to implement Grid tools and techniques. The results (see Appendix F) are consistent with the *Technology Counts* survey results published by Education Week (May 8, 2003). In terms of operating systems deployed, the accessibility of computers to students and teachers, and the multimedia capabilities of these computers, the functionality necessary to support Grid–based projects is there. 94% of schools nationwide have Internet, with 81% of these computers located in library or media centers. Additionally, over 40% of the computers that are available have sufficient capabilities to use the projected tools. One issue in particular represents a significant impediment for full two–way exchange of information, namely the use of restrictive firewalls to control access. This is a non–negotiable issue for many institutions. Finally, there appears to be some interest on the part of the teachers in contributing to the developer resources. This may include computing power, storage capacity, or more likely, the development of computing code that would become part of the Grid infrastructure.

Examples of Current Online Resources

- **ATLAS** provides informational multimedia resources. They are working on a 3–D animation that will explore detector components and show what an event looks like in parts of the detector.
- **CMS** provides information multimedia resources and will have test beam data available soon. These data can be made available so students can take ownership of the data. Three levels of involvement include: test beams for calibration, electronic logbooks—shifts and controls and triggers.
- **Fermilab** has online classroom materials that use Fermilab data from CDF, DØ, E687, and a cosmic ray detector. BTeV is developing some data–based materials. Fermilab has non–data–based online materials such as Fermilabyrinth or QuarkQuest.
- **Jlab's** website hosts hands–on activities, puzzles and games.
- **LIGO** has engaged in formal teacher/student programs to bring scientific research into the classroom in a research–team model. Resources available online include activities, lessons and projects.
- A large number of efforts to study of cosmic rays in classrooms come under the umbrella of **NALTA** (North American Large–scale Time–coincidence Array), including the Cosmic Ray Observatory and others. Individual groups have a variety of online resources to support their work.
- The **Particle Data Group** hosts The Particle Adventure and soon The Universe Adventure websites.
- **PPPL** hosts the Interactive Plasma Physics Education Experiences website including a virtual Tokamak and virtual magnetic stability module.
- The **QuarkNet–Grid Project** is creating an online cosmic ray collaboration that uses virtual data techniques and tools.
- The **SDSS** Skyserver presents science projects that explore data mapping a large part of the universe.

Next Steps

We identified two major steps:

- Complete the cosmic ray collaboration website as a model of an online, inquiry–based, data–driven classroom activity that uses virtual data techniques and tools.
- Become a collaborative; activities include:
  - Establishing an organizational structure.
    - Establishing participants as temporary steering committee
    - Contacting those who could not attend to confirm “membership”
  - Determining the level of “integration engineering” needed to maintain the collaborative.
  - Determining development roles for educators, research scientists and computer scientists.
  - Preparing planning grant proposal to support:
    - “Integration engineer”
    - Second meeting with more participants when cosmic ray model is ready for large–scale pilot
    - Consultations with other developers of online projects who have been down this road before
    - Coherent design for emerging tools, simulations and approaches to data analysis

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Summary of Issues

Content Issues

- Make the focal point of these projects data and data analysis in the service of understanding of physics concepts.
- Provide a way for physics to step out of the box in exciting, meaningful and wondrous ways.
- Develop two types of sites: datasets keyed to big ideas from the experiments and datasets for Introductory Physics experiments.
- Establish a uniform format for datasets that is platform–independent.
- Allow for contributions of data and results as well as the retrieval of information.
- Allow for levels and scales of use, e.g.:
  - Small datasets for beginners progressing toward massive sets for more experienced users.
  - Support tools ranging from simple to more sophisticated to match multiple learners.
- Support inquiry–based learning methods.
- Make explicit socio-cultural aspects of huge scientific collaborations.
- Link to materials that explain the Grid.
- Develop assessment tools and strategies.
- Provide support materials for teachers – PowerPoint, QuickTime, Excel-compatible data.
- Provide materials and suggested strategies for integrating into the classroom environment, using both information technology tools and more traditional, non–technology tools.

Design Issues

- Keep things visual and support a consistent visual metaphor throughout site.
- Plan a user-friendly site navigation.
- Pay attention to issues of GUI development and the structure of student inquiries (learn from experiences of GLOBE, CoVis, etc.).
- Use a standard set of web-based, open source, software tools.
- Make components printer–friendly and able to fit on standard media such as a CD.

Professional Development (Teachers) and Support (Students) Issues

- Include as topics: background knowledge, data collection and analysis, technology usage and troubleshooting, collaboration and presentation strategies.
- Establish synchronous and asynchronous delivery mechanisms such as workshops, online help tools, expert contacts, e-mail, tutorials, and a help desk.
- Emphasize long–term relationships over episodic opportunities for learning.
- Provide online collaboration resources that allow teachers and students to work through issues and questions together.
- Foster buy–in from the broader school community (administrators, parents, teachers).

Needs Assessment Workshop

Agenda Details – January 29, 2004

DESIRED OUTCOMES

Morning Session

8:30 am – 11:30 am

Upon Entry...	Participants indicate their individual understanding of a) grid computing and b) scientists use of grid resources using two charts showing scales of -1 to 10.	***Engage Participants***
Welcoming Remarks		
Introductions	Individuals introduce themselves while engaging in an information gathering process around online learning experiences and resources	***Probe for Understanding***
Panel Discussion	Mike Wilde – The grid in a nutshell Randi Ruchti – Vision for grid techniques to transform science education Elisabeth Roberts – Educational benefits for this vision of teaching and learning	***Clarify & Excite***
Small Group Discussion	Small groups discuss interest in using the grid and grid techniques to meet instructional goals; dream "what's possible?" *[Capture results on chart paper & laptops]*	***Brainstorm & Capture***

Afternoon Session

12:30 pm – 3:00 pm

Research Physicist Discussion	Randy Ruchti – Introduction to CMS Physics	***Clarify & Excite***
Small Group Discussion	Small groups envision characteristics of grid resources that support success in meeting instructional goals; "what would they look like?" and "what would they do?" *[Capture results on chart paper & laptops]*	***Brainstorm & Capture***
Closure & Reflection	Individuals share thoughts on the day and the potential for further work; reflect in writing on the day's events	***Respond & Reflect***

Developers Workshop

Agenda Details – January 30, 2004

DESIRED OUTCOMES

Morning Session

8:00 am – 11:00 am

Welcoming Remarks		
Small Group Discussion	Individuals introduce themselves while sharing current and planned education/outreach efforts (limited to 10-12 minutes per project) *[Capture results on chart paper & laptops]*	***Share & Inform***
Large Group Sharing	Participants examine the discussion points from previous small group work by walking around and viewing chart papers *[Leave questions & ideas on post-its]*	***Probe & Clarify***
Needs Assessment Summary	Presentation and discussion of teacher's needs assessment information; "what do teachers and students need?" *[Capture results on chart paper & laptops]*	***Inform & Analyze***

Afternoon Session

12:00 pm – 3:00 pm

Small Group Discussion	Draft guidelines for future educational grid application development and discuss roles that introductory students might play in this work *[Capture results on chart paper & laptops]*	***Brainstorm & Capture***
Large Group Sharing	Participants examine the draft guidelines from previous small group work by sharing and discussing chart papers *[Leave questions/ideas on post-its]*	***Probe & Clarify***
Closure & Reflection	Individuals share thoughts on the day and the potential for further work; reflect in writing on the day's events	***Respond & Reflect***

Needs Assessment Workshop

January 29, 2004

Breakout One: Needs & Wants

Group 1

- One good project (sensational)
- Excellent visual model of data first (shodor histogram)
- Working offline 1 minute
- Modify and create new models
- Front page very inviting
- Professional development in content knowledge, manipulating data, using technology
- Visualization
- Conferencing
- Sites need areas for teachers, background knowledge (reading and doing are different), ability to post results from teachers and students (what I did), not depend solely on computer (offline), simple model (teachers and students)
- Training opportunities to try data analysis themselves, long–term relationships, troubleshooting, access to physicists
- Where does Grid come in
- Integration of computer skills
- Completely Excel friendly (format of data as text)
- PowerPoint introduction for classroom
- Fit on CD (works with professional development, link for real data, static data on CD)
- By–in from administrators, standards, student parent enthusiasm
- How to get "all" physics teachers to use this
- How to get word out (marketing, training)
- Put students face–to–face (locally, regionally, nationally)
- Efficiency issues (one clearinghouse type website, standardized presentation, format, project presentation, printer–friendly format

Group 2

- Initiating wonder, Sparking curiosity
- Understandable data Keyed to big ideas
- Facilitate inquiry
- Empowerment

Curricular Needs

- Data for experiments say in DC Circuits in which students gain an inquiry experience using datasets
- Good for school with little access to materials
- Schools posting data
- Collaborating on data collection
- Standard set of software tools, web-based
- Open source
- Practice tests for standardized tests
- Inquiry –based projects backed by pedagogical steps
- When addressing a particular topic, identify where that activity falls in the learning cycle
- Assessment rubrics and tools
- QuickTime movies to allow students to do time studied (time-lapsed)
- Library of key experiments digitized for data collection

Curricular Wants

- Rubric of the "process" (learning cycle) identifying where in the cycle an activity fits

Group 3

- How to weigh two different claims about data
- How to determine signal and noise (it's not cut-and-dry)
- What skills do you need to come out (of a Grid experience with); at what "grade" levels; for which

groups (citizens, grad students, business people, voters)
- How and when to go from 10 points of data to 10,000
- More understanding of what is the Grid, its capabilities; Mike filled us in: tools to enable the data analysis process; virtual data: track what you've done with the data, methods of cataloging data.
- [NOTE TO WHOMEVER: I spent about 3 hours examining the Grid website and Grid café, and did not come away with the understanding that the Grid tracks the operations on data—the Java simulations make it appear to be only a data sharing-data crunching tool.]
- Ability to carry on long–term projects…breaking them into steps (scaffolding, what is it? what's needed?)
- Use the data process tracking capabilities to assess students' processes and thinking/understanding about data analysis
- How to know where to find the tools
- How to navigate the different "levels" of technical capabilities and views of data
- What are transforms and how they operate on data
- How will the GRID help me build scaffolds or content knowledge? Is it supposed to do this? Is it a hammer or a screwdriver? I don't mind if it's a hammer, not a screwdriver but I need to know to decide whether to use it.
- Have to help other teachers see the value of Grid (if there is, if we decide there is)

Group 4
- By collecting data from your school, you will be able to compare your data with distributed data (take data of long jumpers, how long the jump, how fast they run, their height and weight; then the data can be compared)
- This would drive the inquiry, and make Physics an integral part of the school day.
- Access to enough data to develop real evaluation tools.
- AP test are an issue–limits time to do inquiry and elective activities.
- Yes, we will use Grid data if its available

Needs (if electronic data available)
- Anything out of the box labs
- Big mixes of activities
- Wish list of experiments with alternative ways to integrate them into curriculum
- Access to data and preparation that will prepare students to handle the data and applying it to the given curriculum; preparation for students and teachers
- Links to interactive learning
- Physics I – data available with visual set up which will allow students to analyze data from labs they did not necessarily have to do
- Promote Physics Clubs or other after–school activities that would interest students (SECME)

Breakout Two: Design Considerations

Group 1
- Strong front page
- Active visual model
- Help desk, person
- Results posting
- Printer friendly
- Presentation friendly (PowerPoint for teachers)
- Fit on CD
- Reproducible format for different types of data & activities
- Site map (plan before you create)
- Data sets of manageable size
- Identify datasets appropriate for various technology configurations (e.g., bandwidth, download time, size–do you want to download or not?)
- Progress monitor as you download
- Beta testing with teachers and students
- Easy method (trip over the data, not over the method)

- Interpretation of results goes to more web pages
- Timely access to experts
- Off-computer work
- Search filter of questions
- Develop & explain how to use at various levels
- Design standards, protocols, procedures
- Excel compatible
- Good data filters
- Valid data flags (turn off or on depending on level of student); could be teacher set, student set or on a spiral

Teacher Side
- Big idea (possible questions, guideline – how to play out, tips)
- Tutorial

Student Side
- Pose question then datasets
- Tutorial to use data

Group 2
- How to get through firewalls to data?
- Use standard browsers/tools; don't reinvent
- Agreed formats for export/import of data files (e.g., CSV)
- All tools look the same (user interface simple)
- Any project should be able to use tools that are familiar to students (Excel)
- How to handle linear "flat" databases vs. relational dbases
- Easy to find things (data, links to content areas)—lots of metadata
- Classify the quality of datasets—who collected, whether cleaned, etc.
- Well-vetted tools: ones that have already worked in classrooms, such as Vernier, Pasco
- Able to upload data to create "universal" datasets from classroom labs (such as drop of milk in oil, or Vernier data)
- What kind of time is needed for the Grid to prove itself "useful" in classroom projects? It depends on classroom and how teacher designs project, as all-at-once or a little bit each week or month throughout the year
- Make explicit the huge collaborations of science, difficulties, the sociocultural aspects
- Models/simulations to look at datasets
- Ways to support students who are ready to "go beyond" their teacher or classroom—access to experts and resources
- Importance of support community
- Teacher professional development and teacher resources built in
- Area for teacher conversations about teaching issues/user issues (e.g., LabNet)
- Ability for students to publish research (e.g., NOAO)
- WIKI resources (editable websites, like weblogs)

Group 3
- Physics I: pre–organized datasets/labs, teacher aids, student aids (variable initial conditions)
- Tutorials
- Consultants (local students as tutors)
- Importing/sharing assignments
- Feedback from students (assessments, discussion boards)
- Working group to assemble datasets
- Competitions (problem datasets)
- Common data for multiple opportunities during academic year
- Tutorial/calculations/needed: concept–driven

Your Understanding of Grid Computing

1		3	2		2	3					
–1	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

Your Understanding of Scientists' Use of Grid Resources

1		2	2	2	3	2					
–1	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

Initial Data Gathering Exercise: Online Learning Resources

Know

- We are driven by the standards
- Sky Server has large amount of data
- Science inquiry is the hook (to the standards)
- Physics comes from the physical world—we shouldn't forget that
- Balance is important
- Selection vs. collection becomes an important issue
- Interest drives learning
- Assessment is problematical and important
- Data goes both ways—receive and contribute
- Do no harm!

Think We Know

- In perspective, impact of usage was uncertain
- Data–driven resources tend to overwhelm students and teachers
- There are a lot of good visualization tools out there, but you need good search strategies to find them
- Time and training limits teacher usage of data–driven resources
- Facts (dry) vs. "video game" (rote and dry) vs. massive databases (complex)
- Virtual lab setup successful in chemistry
- Some data are unclear
- Integrate ideas across standards
- Use common tools
- Online vs. hands–on meets different needs (progression over time)
- Sometimes it feels like drinking from a fire hose
- Online tutoring programs (University of Illinois PLATO) used with mixed results
- We need a front end to datasets
- Tools must deal with student pre– and misconceptions
- Match tools to learners
- Concepts vs. process must be balanced
- Online tools/homework take less time for teachers but are problematic for honest collaboration
- Students come in as rote learners
- Tools must support inquiry learning
- Central query center for datasets (set standards for format)
- Grid computing is analogous to SETI@home
- Accessibility issues (socioeconomic, disabilities, diversity)
- How do we provide understanding to students to questions they haven't asked
- Using vs. creating models; both are important
- Divergent conclusions are okay

Need To Know

- A middle–ground between teacher–driven tutorials and online data–driven sites that are student–driven
- Where the resources are and how to find them (visualizations)
- How to do and integrate sites into curriculum and satisfy standards

- How to use data–driven sites (for teachers and students)
- Which data are relevant in large datasets? What measurements? What can be ignored?
- How to integrate multiple standards
- The potential of data–driven sites for the standard related to “how scientists work, nature of science”
- Power of Excel and how online data can be used in Excel? Which fields to import? How are data formatted?
- Know how a resource will help teach a particular concept such as momentum upfront
- How to find resources that avoid cheating
- How to teach them how to inquire
- How do you think about data
- What tools they can use
- Central clearinghouse for where data reside; queries and the format of data; uniform interface
- What is Grid computing
- How can I use Grid computing to implement a particular calculation
- How to understand modeling tools and the connection between data–driven activities and model building
- Explain relevance of discipline as a motivator (for med students, the relevance of physics)

Final Reflection: A–ha’s

- As useful as Grid is, there will need to be experts/consultants out there to support (students and teachers)—lots of teacher-scientist interactions.
- Students as apprentices in a community of practice.
- Don’t create false dichotomy of novice vs. experts (scientists as experts) because that might scare some students off.

A special thanks to the teachers who contributed their time and expertise to this effort:

Richard Allen	South Miami High School, Miami FL
Rafael Arechabaleta	University School of Nova Southeastern University, Ft. Lauderdale FL
Rolando Branly	Broward Community College, Miami FL
Tom Carter	College of DuPage, Glen Ellyn IL
Jorge Gilbert	Miami Sunset Senior High School, Miami FL
Frank Jurado	South Ridge High School, Miami FL
Patrick Mooney	Penn High School, South Bend IN
Eric Muhs	Roosevelt High School, Seattle WA
Laszlo Nagy	American High School, Miami FL
Lynda Rose	Trinity High School, Mishawaka IN
Deborah Roudebush	West Springfield High School, Springfield VA
Robert Sparks	The Prairie School, Racine WI

Developers Workshop

January 30, 2004

Education & Outreach Efforts Discussion

QuarkNet

- Students can get involved at multiple levels (user, contributor, developer)
- Making student work (creating and modifying) dynamic is under development; implementation issues problematic
- Software design teams commit resources to focus on interface metaphor issues; we look at other projects, but time is an issue–how to find and commit resources to something that is in between roles and outside GriPhyN charter
- Blending of roles, computer science, physics, and education, is critical: how to set up accountabilities and responsibilities
- The unification and leveraging of nationwide efforts will require full–time personnel support
- Perhaps we should go back to Marv Goldberg and report the results of our initial efforts to bring Grid techniques into high school physics; here is what we know and here is what it will take to further this work–is there support for investment in infrastructure?
    - Train students first on data management techniques and collaboration; then move on to more massive datasets
- New model for scientific collaboration: location independent, amorphous, uses Grid, education
- There is an idea for a virtual lab for physics in education
- Which comes first: Grid tools for education or education to Grid tools
- What paradigm of simple computation exists (programming tools and techniques)
- A great deal of programming efforts lies with bringing uniformity and error correction to data files; how to remove this barrier for students; a **data format standard** would be useful **(Excel CVS w/column headers)**
- Tools are close to supporting metacognition about data and data analysis
- Building something simple for the user is hard for the developer
- Deconstruction and analysis of efforts for usefulness would be helpful
- Simple things should be simple, complex things should be possible
- Different types of users: those with in–depth analysis experience and those who enter less formally; each should be supported in their usage (experts with detectors, experts without detectors, interested but informal); we are working with one cell of the **matrix of educators and tools (see below)**
- Schools could provide data–analysis shifts for support (timescale variable): types of questions (interface, usage, physics)

Cosmic Ray Observatory Project (Nebraska)

- Looking to gather data and correlate results both within CROP and with QN; have not seen such events, but without the detectors, we will never see them
- North American Large–scale Time–coincidence Array (NALTA) will enable collaboration of efforts
- If we address the data quality and analysis issues, there is tremendous potential
- Our development wish list:
    - Monitoring and status info
        - Individual school info database (detector details, people involved)
        - Individual school data–related info
        - Multi–school data–related info (MapQuest–like ability)
    - Datasets
    - Analysis tools
        - Individual school analysis tools
        - Multi–school analysis tools
    - **Simulation tools database** (issues: cpu–intensive, existing ones often not appropriate–different energies, incident angles, altitudes)
        - General

        - Specific to given collection of schools and datasets
        - Represents real application of Grid tools
- Develop the mapping tool to accept any type of data (selection and visualization)
- Real–time and archival displays of data
- Making the connection between geographic representations and histograms from particle physics (rolling and unrolling representations)
- What is balance between running interface monitoring software locally or on Grid (pros and cons)

ATLAS

- ParticleAdventure.org website developed
- CPAP
- Have created an award–winning movie about efforts
- Working on an animation of detector in action
- Have created Hands–On CERN resource
- LOG combines several CERN efforts
- Have produced several resource charts for teachers
- UniverseAdventure.org is under development
- Have organized a joint Northern California AAPT and APS meeting

Sloan Digital Sky Survey/VERITAS

- SDSS
    - About 70% of projected data collected
    - Linking with Hands On Universe
    - Linking with other datasets
    - Providing templates for users
- Very Energetic Radiation Telescope Array System (VERITAS)
    - Integrate Grid via air show simulations and optical monitoring of AGN light curves

CMS

- Test beam data will be available soon; provides calibration situation
- Electronic log books offer ways for students to examine process and build ownership
- CMS triggers: remote triggering (and data collection) of detectors; allows for a location to gather data from the network for a short period of time (a data run)
- Persistence of vision idea (series of vertical arrays of LED sticks): allows for remote display of information
    - Visualization tool of controls on experiments; allows for remote data collection

LIGO (WA)

- Science as Student Teacher (SST): bringing research into the classroom (scientists using student–collected data)
    - Computers that can move a reasonably small amount of data and access to Office
    - Gathering of baseline data used for calibration
    - Example: Teacher and students joined research team assigned a data channel from a seismometer to monitor (build understanding of instrument and software, develop implementation plan, develop people skills) in order to create a long–term trend in microseism
    - Use web tools and office component to manage and analyze data
    - Tools and strategies have rippled into other subjects and to many students

Summary & Next Steps Discussion

Impressions from technology survey and Needs Assessment meeting

- teachers are interested
- reach about 10% students
- more users than developers
- KISS (common interfaces, simple tools, materials at different levels)
- mixed platforms of computers

- physics teachers tend to be high–end users

We need an “integration engineer”
- someone who makes sure the pieces fit together
- 50% architecture, 50% support
- connective tissue
- empowered via: proposal, collective accountability with milestones to a steering committee that provides a charge and a course (physics of universe idea before NSF)

Question before us: is this a formal process (proposal) or grass roots (happens because of efforts)?

To Dos:
- Deconstruct and annotate work flow
- Develop portal further – upload process and analysis tools
- Front–end GUI work
- Make something fully functional

Develop RFP for resources through a planning grant

Repeat this meeting (focus group)
- Larger number of teachers
- Tools fully functional
- NSF people in attendance

Plant seeds, then matching support can leverage efforts

Has to be bought into by larger communities (research/education/Grid)

Advisory role for others who've been down this road

A Metaphor–TurboTax software illustrates possibilities

Create and distribute to email list (Laird) a one–page outline of what we want to accomplish with the planning grant

Develop draft of data analysis epistemology

Develop matrices:
- **Roles**

	Educator	**Project Scientist**	**Grid Scientist**
Roles	–	–	–

- **Support, Instructional Goals** (TBD) – develop for each user separately (?)

	Developed User *Has a detector and is a member of QN*	**Emerging User** *No detector and is a member of QN*	**Beginning User** *No detector, not a member of QN, isolated*
Use Data in Classroom			
Examine Portal Tools			
Skin Developer			
Transformation Developer			

Technology Infrastructure & Access Survey

Computer Operating System	**Percentage in Use** (only for those operating systems checked)			
	1 – 25	**26 – 50**	**51 – 75**	**76 – 100**
MS Windows 95	○	○	○	○
98	○	○	○	○
ME	○	○	○	○
NT	○	○	○	○
2000	○	○	○	○
XP	○	○	○	○
Macintosh OS 7	○	○	○	○
OS 8	○	○	○	○
OS 9	○	○	○	○
OS X	○	○	○	○
Linux	○	○	○	○
Unknown	○	○	○	○

Internet Browser Type (Choose most prevalent)					
Internet Explorer 6.x	○	Netscape 7.x	○	Safari	○
5.x	○	6.x	○	Other (OmniWeb, Opera, iCab Camino, Mozilla)	○
4.x	○	4.x	○		

Computer or Network Capabilities			
	Yes	**No**	**Don't Know**
Internet Browser			
Accepts cookies	○	○	○
Saves bookmarks	○	○	○
Downloads files locally	○	○	○
Downloads files to network	○	○	○
Can use JavaScript	○	○	○
Can use Java applets	○	○	○
Can use other media plug-ins	○	○	○
Program Installation			
I am allowed to do this	○	○	○
Technology department does this	○	○	○
Printing			
Documents (i.e., Word, PDF)	○	○	○
Web pages	○	○	○
E–mail Access			
Web–based	○	○	○
Client–based (i.e., Eudora, Mail)	○	○	○
Internet Content Filtering			
Actively (as web pages are delivered)	○	○	○
Computer Access			
Login & logout required at all times	○	○	○
Executing Programs			
Can run locally (programs reside on machine)	○	○	○
Network–based (programs reside on servers)	○	○	○
Can run unattended	○	○	○
Can run in background	○	○	○
Can initiate web connections	○	○	○

• PLEASE PROCEED TO PAGE 2 •

Enrollment Numbers

How many students are enrolled at your institution?	How many students might possibly be involved in using Grid tools and techniques through either courses or independent research?

Computer Access Locations and Numbers

Physics Classroom		Science Lab		General–Purpose Lab	
0	○	1 – 6	○	1 – 6	○
1 – 2	○	7 – 12	○	7 – 12	○
3 – 5	○	13 – 18	○	13 – 18	○
6 or more	○	18 or more	○	18 or more	○

Policy Implications

Grid developers envision multiple user levels, differentiated by the amount of access to Grid resources and techniques. One level of user might only have access to Grid information through a web browser, while another level would actually contribute computing power, storage capacity, and/or computing code to the Grid. What policies are in place at your institution that would impact any of these projected levels of usage?

Involvement of Others

The levels of usage described above provide opportunities for students and teachers to be either users and/or developers of Grid tools and techniques. What level of projected usage do you envision at your institution?

	User (Information Retrieval)	**Developer** (Resource Contribution)
Physics Teacher		
Physics Students		
Computer Science Teacher		
Computer Science Students		
Others (specify)		

Are there others at your institution, such as technology or computer teachers, administrators, or IT department personnel, who could provide greater clarity or another perspective on these issues? If so, please provide contact information below (if possible).

Name	
Role	
Phone	
E–mail	

• THANKS SO MUCH FOR YOUR PARTICIPATION •

Technology Infrastructure & Access Survey **N**
Needs Assessment Workshop Results 04–Jan 11

Computer OS	Percentage in Use			
	1–25	26–50	51–75	76–100
Microsoft Windows				
95	1			
98	3	1	2	
ME	2			
NT	0			1
2000	2	2	2	1
XP	3	1	1	1
Macintosh				
OS 7				
OS 8		1		
OS 9	2		1	
OS X	3	2	1	
Linux	2			
Unknown				

Internet Browser Type

Internet Explorer		Netscape		Safari
6.x	7	7.x	1	Other
5.x	2	6.x		
4.x		4.x		

Computer or Network Capabilities

	Y	N	DK
Internet Browser			
Accepts cookies	10		1
Saves bookmarks	11		
Downloads files locally	9	3	
Downloads files to network	10	1	
Can use JavaScript	10	1	
Can use Java Applets	10		
Can use other media plug-ins	10		
Program Installation			
I am allowed to do this	9	2	
Technology department does this	9	1	
Printing			
Documents (i.e., Word, PDF)	11		
Web pages	10		1
Email Access			
Web–based	8		1
Client–based (i.e., Eudora, Mail)	5	4	
Internet Content Filtering			
Actively (as web pages are delivered)	8	1	1
Computer Access			
Login & logout required at all times	5	5	
Executing Programs			
Can run locally (programs on machine)	9	2	
Network–based (programs on servers)	10	1	
Can run unattended	8	1	2
Can run in background	9		1
Can initiate web connections	8	1	2

Enrollment Numbers

Total	Possible Involved		
400	300		
3600	300		
3000			
2950	150		
32000			
2270	150		
265	265		
700			
1600	150		
650			
3000	90		
50435	**1405**	**3%**	**All**
18435	**1405**	**8%**	**All w/o FIU**
14085	**1405**	**10%**	**Respondents Only**

Computer Access Locations and Numbers

	0	**1–2**	**3–5**	**>6**
Physics Classroom		4	2	5
	1–6	**7–12**	**13–18**	**>18**
Science Lab	4		2	1
	1–6	**7–12**	**13–18**	**>18**
General Purpose Lab	3		2	6

Involvement of Others

	User	Developer
Physics Teacher	7	3
Physics Students	7	2
CS Teacher	1	2
CS Students	1	2
Others	1	1

Policy Comments

Access grid information but unable to contribute resources

Uploading no problem; download would require additional permissions and software

Would need to contact our IT department

Firewall with NAT enforced by IT department; getting a single, temporary hole through would require months of discussion

Computers and network utterly locked down; requires and act of congress to do anything other than Office and IE

Others

Victor Hernandez	Technology Director	305.557.3770
	New Tech Coordinator	will be sent
Thomas Loughran	Teacher	574.287.5590
		tloughran8@nd.edu
Bill Ogden	Network Admin	wogden@prairieschool.com