■ A K-12 NETWORKING AND COMPUTING NEWSLETTER ■

NETVIEWS

VOLUME 1, NUMBER 1, MARCH 1992

INTRODUCTION

Pat Burns and Dave Zachmann

This is the first in a bimonthly series of newsletters dealing with computing and networking in public education. This newsletter is intended to be a forum for the presentation and discussion of general activities in computing and networking, specifically targeted towards the K-12 community. This newsletter is an outgrowth of a project at Colorado State University funded by the Oak Ridge National Laboratory. The purpose of the project is to assist the K-12 community in incorporating computing and networking in their curricula, as a mechanism to enhance and extend the educational experience.

The project is jointly directed by Drs. Pat Burns and Dave Zachmann. Dr. Burns is a Professor in the Department of Mechanical Engineering and Dr. Zachmann is a Professor in the Department of Mathematics. Dr. Burns is also the Principal Investigator of the Westnet regional network, which provides digital data networking for the states of Arizona, Colorado, New Mexico, Utah and Wyoming, and southern Idaho. One particular emphasis, unanimously supported by all in Westnet, continues to be the extension of the network to the K-12 community. Dr. Burns teaches the Freshman Introduction to Engineering course at Colorado State University, which heavily involves computing and networking. Dr. Zachmann is the Coordinator of Advanced Technical Computing at Colorado State University, and is active in the use of visualization in computational systems. Both are fully committed to the concept that computing and networking can significantly impact the quality of K-12 education.

EDUCATION

"Education is that which remains when one has forgotten everything one ever learned in school." - A. Einstein, *Out of My Later Years, On Education,*

"In science, it is not so much what one knows, but how and why one knows it." - B. Russell, *History of Western Philosophy.*

Education may be interpreted as teaching one to think, while training may be interpreted as teaching one to do. It is the theme of this effort that the proper blend of these two approaches is necessary to be maximally effective. Indeed, we perceive that about 85% education and 15% training is an appropriate division of approaches.

"Idols of the Schools is thinking that some blind rule can take the place of judgement." - Francis Bacon.

The traditional approach to education is to treat students as recipients of information. Our approach is to treat students as generators of information by requiring them to take the intellectual steps required to gain knowledge. This necessarily heavily involves hands-on experience. We view computational capability as most appropriate to involve students in the process. Computers are largely responsible for the information explosion. Used properly, computers should serve the educational community in managing this explosion. To this end, we propose the extension of computing infrastructure to the K-12 community. Initially, this will involve primarily high schools. Our goal is the construction of a "seamless web" of computing infrastructure from K-Ph.D.

These activities are epitomized in the following quote:

"The restructuring of the American school is becoming a reality. National, state and local political leaders are sounding the cry for changes which will improve our educational system and global economic clout." Owen Smith, Proceedings of the RAM-JET Committee, Colorado State University, 1991.

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ACTIVITIES

In-Service Training Sessions

The offering will be phased in over three years. The first year will begin with five in-service training sessions involving from 50 to 80 High and Middle School Teachers from Colorado. The topics to be covered are:

In-Service Training Topics:

1. Unix Basics

2.The Internet as a Classroom Resource

3. The Role of High Performance Computing in Education

4. Symbolic Manipulation in Mathematics and Science Classes

5. Visualization as an Educational Tool

Summer Workshops, Videotaped Courses

We propose to stimulate participation in high performance computing by offering summer workshops to high school teachers and students. High school teachers may earn credits toward advanced degrees or re-certification credits. Mechanisms for this are already in place through our Division of Continuing Education. Also, some of our regular courses (such as GS-510 Fundamentals of High Performance Computing and Visualization) are offered from 4 to 5 PM, making them available to teachers in the Fort Collins, Boulder and Denver areas. The GS-510 course is also available via videotape to teachers at remote sites.

Each summer, we shall offer to high school students and teachers in-service courses and workshops in advanced computing and visualization. Separate courses will be offered to teachers and to students. Participants will be encouraged to engage in a state supercomputing competition. A selected set of students will be encouraged to take their results from the state competition, and hone them even further for national supercomputer competitions such as Superquest. Initially, these courses and workshops will utilize the computing facilities at NCAR (National Center for Atmospheric Research) in Boulder. In future years, the computing facility for high school education at NERSC (National Energy Research Supercomputer Center) in Livermore, California at the Lawrence Livermore National Laboratory will be utilized.

It is our hope that participation in the efforts described above will allow students to “hit the ground running” when they encounter their first computer course in the university. Also, we wish to encourage the teaching of computer languages in high school, particularly FORTRAN and C. This appears to have lapsed seriously over the past few years, in favor of teaching spread sheets and word processors.We find this trend disturbing, as computer languages teach the intellectual skills requisite in problem solving.

Curriculum Augmentation Modules

CSU professors, working with high school teachers, will develop modules on simulation modeling that will be used to introduce high school students to mathematical simulation modeling. In the first year, we shall devise six modules. Subsequently, we shall devise new modules, and enhance and further develop existing modules. The modules initially will be designed to be mouse-driven for IBM type PC’s with EGA and above graphics screens and eventually for Macintosh architectures.

User interfaces employing the Socratic method of education (requiring responses to provocative questions) will be developed. In this way, students will devise their own approaches and understanding of science and mathematics, and be able to extend their efforts with original thinking. Great care will be exercised to ensure that all modules are of the very highest quality. We note that these programs are not AI-based. All will be done in a procedural language, and require an instructor to be present locally to guide the student through the exercise. Some will be coupled with physical experimentation - allowing numerical simulation and modelling to be placed in the context of the real world.

Simulation

We are confident that this material can be made accessible to a high school student whose background includes algebra and some science (e.g. physics, biology or chemistry). We shall use simple algebraic formulas to model the fundamental principles. For example, a biology student could be introduced to culture growth modelling by beginning with a simple algebraic expression such as,

No. of Cells at t2 - No. of Cells at t1 = (Growth Rate)*(t2 - t1)

Students will begin by performing calculations on a hand-held calculator and graphing their results. The students could then move their calculations to a supercomputer and their tabulation to a graphics screen. Many extensions of such a simple model are then available. For example, exponential growth could be replaced by logistic growth, or a simple predator-prey model could be introduced. This can (and should) all be done without students or teachers even knowing there is a field called Differential Equations. In fact a differential equation never rears its head in our high school level simulation modeling material.

We are very excited about this effort, and hope to infuse many of you with our enthusiasm. We anticipate that much of our effort will occur in the late spring, as we are just now getting started on this phase.

NETWORK USES

Here, we briefly provide some of the uses which have been found for networking in the classroom - specifically in high schools. Among the most common uses is electronic mail, which is used to communicate with others who have access to remote computers. For example, Dave Swartz at Rocky Mountain High School teaches a class in Environmental Studies. His students have access only to our western ecosystem. However, to overcome this limitation, Dave’s students correspond via electronic mail with students in Australia and Newfoundland - both with radically different ecologies than Colorado. Students at all sites collect data particular to their area of the country, and all share the data for analysis. Thus, it is possible to broaden our parochial viewpoint, which is geographically constrained.

Foreign language teachers use the Internet (the "network of networks" spanning the globe) to communicate with foreign students. For example, a German teacher in the USA might have his or her students writing electronic mail letters in German to students in Germany, who respond in English. Each set of students critiques the others contributions, providing an interactive education experience in both their native language (explaining elements of grammar to foreigners) and the language under study. Also, some unique cultural exchanges can be established in this fashion.

Some journalism classes at Rocky Mountain High School in Fort Collins have been exchanging newspaper articles in an Academy One project via the Cleveland FREENet. In this activity, articles are posted, and thereby made available to all participants. The articles tend to have a distinctly regional flavor, promoting cross-cultural awareness and an expansion of our societal mores. Also, this is an excellent way to obtain many articles for the school newspaper for every one that is written locally.

An emerging area is that of visualization across the Internet. Currently, the focus is on X-windows applications, requiring an X-windows terminal. There are many free software packages and images available via the Internet. Particularly, there are many beautiful images captured by NASA from the Hubble telescope, the Magellan and Viking missions, etc. When studying astronomy in the classroom, instructors have found such images of great value to involve students in the large-scale science of national scope currently being conducted. Finally, there are weather maps of varying scale available which are only 20 minutes old (students are able to tell their parents what they will see on the weather forecast beforehand).The scales of the weather maps range from the North American continent to local Colorado maps.

These are just examples of the many uses of networking. In fact, by participating in networking, you will be involved in establishing "leading-edge" uses of networking. When widespread networking was begun over five years ago, no one had the remotest notion how widely and diversely networking would be used. The network has been a success beyond our wildest dreams; it is truly changing the way we conduct our lives. Some have said that the network was built on the "field of dreams" philosophy - *Build it and they will come*. We encourage you to participate in this exciting and stimulating endeavor.

Networking enhances learning in a variety of ways. First, it pro-actively involves students in their work. Secondly, it encourages students to compose well written articles (with good grammar, paragraph structure, spelling and punctuation) for transmission across the Internet to their peers. Thirdly, there is a tremendous volume of material available via the Internet, and some emerging technologies for searching library data bases topically both quickly and easily. All of this is accomplished in seconds, with messages transmitted anywhere in the world, requiring not even a postage stamp!

CONTRIBUTIONS

We welcome contributions from interested parties, and will "encourage" those of you active in this area to submit articles from time to time. In particular, we are interested in hearing about activities in computing and networking from the K-12 community.

DISTRIBUTION

There is no charge for this newsletter, and our intent is to maximize distribution. We shall distribute this newsletter every other month via US Postal Service and via electronic mail. We encourage you to distribute copies of this document to your colleagues, via forwarding of the electronic mail file, or distributing copies of the hardcopy document.

If you wish to be added to our mailing list for this newsletter, please respond with your U.S. Postal Service address, phone number, and electronic mail address (if you have one) to Dave Zachmann at the address given on page 4. Also, please include your affiliation (e.g., your organization such as Rocky Mountain High School) with your request.

WORKSHOP ANNOUNCEMENT

Adventures in Networking and Supercomputing

First Annual Conference
Colorado State University
Fort Collins, CO 80523
Sunday, August 2, 1992 through
Friday August 7, 1992
Open to High School Students and Teachers

This activity is funded by the Oak Ridge National Laboratory. All materials, meals, facilities and accommodations will be provided to participants. There will be no charge for attending. Participants will receive free computing and visualization software. Teachers will receive a small stipend for attending.

The workshop is intended to introduce students and teachers into the use of networking and computing in the classroom. The exposition will heavily involve hands-on exercises. The tentative outline of topics follows.

WORKSHOP OUTLINE

Sunday - Aug. 2

4:00 PM Introduction, Welcome

Monday- Aug. 3

8:00 Overview of Networking and Computing
9:00 Introduction to Networking in the Classroom
10:00 Electronic Mail (hands-on)
12:00 Lunch
1:30 NetNews (hands-on)

3:00 Information Resources on the Internet
5:00 ftp, telnet (hands-on)
5:30 Dinner
7:00 Hands-on Exercises

Tuesday - Aug 4

8:00 Review of Yesterday's Topics
9:00 Introduction to the C Programming Language (hands-on)
12:00 Lunch
1:30 The C Programming Language (cont'd) (hands-on)
5:00 Free Time
5:30 Dinner
7:00 Hands-on Exercises with C

Wednesday - Aug. 5

8:00 Advanced Concepts in C (hands-on)
12:00 Lunch
1:30 Visualization Using C (hands-on)
5:00 Free Time
5:30 Dinner
7:00 Hands-on Exercises with C - Graphics

Thursday - Aug. 6

8:00Large-Scale Computing with C (hands-on)
12:00 Lunch
1:30 Introduction to Supercomputing
5:00 Free Time
5:30 Dinner
7:00 Hands-on Exercises using NCAR's Cray Y/MP

Friday - Aug. 7

8:00 Project on NCAR's Cray Y/MP
12:00 Lunch
1:30 Group Picture
3:00 Wrap-Up
4:00 Adjourn

APPLICATIONS

Applications are invited to participate in the above workshop. Teams of applicants are invited to apply. Ideally, we would like teams of two students and one teacher per school, but we will make exceptions for special circumstances.

Applicants should provide the following information, typewritten, which should be returned to Dave Zachmann at the address given below:

1. Name.

2. Home Address - if a teacher, this should be the school mailing address.

3. Home Telephone Number - if a teacher, this should be the school telephone number.

4. School.

5. Grade - e.g., 9th, 10th, etc. If a teacher, describe teaching experience.

6. Areas of Interest - This should include programming experience in applications areas, if any (for example, communications programming, creating visualizations using BASIC, etc.) If a teacher, describe duties and classes taught.

7. Computing Experience - this should include both languages (e.g., BASIC, Pascal, C, etc.) and computers (e.g., IBM PC, Macintosh, etc.).

8. Other pertinent information, at the discretion of the applicant.

CONTACT INFORMATION

The contact information is as follows:

Pat Burns
Department of Mechanical Engineering
Colorado State University
Fort Collins, CO 80523
(303) 491-7260
pburns@yuma.ACNS.ColoState.EDU

Dave Zachmann
Department of Mathematics
Colorado State University
Fort Collins, CO 80523
(303) 491-1575
dzach@Darcy.vis.ColoState.EDU

Dave Zachmann
Department of Mathematics
Colorado State University
Fort Collins, CO 80523