DRAFT
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Pretty good summary of Athena...
Please return to my mailbox.
Greg

QUESTIONS AND ANSWERS ABOUT PROJECT ATHENA

by

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Preface

Project Athena is the largest university-wide educational program MIT has ever undertaken. Over time, Athena will influence the academic and social environment at the Institute in diverse ways.

As with most ambitious programs, Athena raises a broad range of questions. This document tries to answer the most commonly-asked questions. It is intended primarily for students who are unfamiliar with Athena, its goals, its progress and its future directions. It also provides pointers on how to obtain more detailed information about various subjects.

If you can't find answers to questions you have, follow the usual approach at MIT--ask someone else. Find someone on the Athena staff, and he or she will try to help.

Athena will probably change your educational experience at MIT. Occasionally, you may experience some of the frustration that always is associated with being on the leading edge of a new technology. At times, the changes seem to occur far too slowly; at other times, they happen too quickly. Just remember that part of the reason you came to MIT was to be part of the excitement associated with the forefront of technology and science!

What is Project Athena?

In May 1983, MIT announced the establishment of a five-year program to explore new, innovative uses of computing in the MIT curriculum. The MIT faculty was concerned that too little was being done to integrate the new computational technology into the undergraduate educational experience. Project Athena, as the program was called, arose from this concern.

At the same point in time, major computer manufacturers were developing high-performance, relatively affordable graphics workstations. The workstations, the faculty believed, could be important tools to enhance learning.

What does Project Athena do?

Project Athena's mandate is to explore diverse uses of computing in support of education and to build the base of knowledge needed for a longer term strategic decision about how computers fit into the MIT curriculum.

In order to reach a decision about the educational computing environment MIT should sustain,

- we encourage a wide range of educational applications to understand how computing helps students learn,
- we place computers in diverse settings to explore how different physical arrangements affect the use and value of computing,
- we experiment with different types of software to learn about its utility, reliability, the ease with which it can be run in a very large computing system and the costs of supporting it.

Project Athena's goal is to improve the quality of education at MIT by fostering innovative uses of a network of high performance, graphics computer workstations.

How does Athena foster educational innovation?

Athena sponsors curriculum development projects. Twice each year, we invite faculty to submit proposals to student-faculty review committees. The proposals, which generally request funding and computational resources, release faculty from teaching or other assignments to develop new software and subject-related materials. Athena also uses curriculum development funds to pay professional programmers and student employees. About half of MIT's commitment of $20 million is budgeted for curriculum development. At the end of the 1985-86 academic year, 98 separate projects were funded through the Resource Allocation Committees. The projects range from small efforts by a single faculty member to departmental- or school-wide initiatives.

What type of computing environment is Athena developing?

One of the problems with most existing computing environments is that each manufacturer provides not only different hardware, but also entirely different software systems. One of Athena's goals is to make the educational computing environment much more integrated. Once students learn to use a particular piece of software, they should be able to use that knowledge throughout their stay at MIT. Ideally, the same software should work on all the workstations in Project Athena. Programs written for one vendor's computer should execute on other vendors' hardware. We call this idea of a unified computing environment ***coherence.***

The goal of coherence has already shaped Athena's software. For instance, UNIX was chosen as the operating system because it runs on a variety of machines. As a general rule, Athena tries to create or license software which is not tied to any single type of hardware.

What are Athena's plans for making workstations available?

Athena's plans include installing workstations in public work areas, living groups, laboratories, libraries, departmental areas, and special curriculum development sites. Experiments with each of these types of facilities are already underway. By the end of the five-year Project, we will have installed about 1,500 workstations throughout the Institute.

The installation of the Athena workstations is divided into two phases. When the Project began in May, 1983, neither Digital nor IBM produced a complete workstation. MIT decided to use the then-available hardware so that we could begin the process of curriculum innovation. As of the Fall, 1986 term, most of the hardware available to faculty and students is part of this first phase installation.

Over the next two years, virtually all of the first phase hardware will be replaced by true workstations. This should provide improved computer performance, including better graphics and response time. Instead of sharing a single computer among many users at once, each workstation has its own processor. Instead of a melange of different terminals, users will all have high resolution, large screen displays.

Will students be able to buy their own Athena workstations?

Right now, the technology being used in Project Athena is too expensive for most students to own their own. Athena was created with the knowledge that computing costs fall 25-30% per year, and that student ownership should be feasible by the end of the Project.

Affordability is an important subgoal of Project Athena. We believe that, by the end of the Project, it should be possible to own and operate a workstation at an annual cost of no more than ten per cent of the MIT tuition. This figure includes hardware, software, maintenance, networking and operating costs. Many of the decisions Athena makes regarding hardware configurations, storage capacity, communications strategy and software licensing are influenced by this objective.

How is Project Athena financed?

Major industrial support for this educational computing Project comes from Digital Equipment Corporation and IBM. Each company provides Project Athena with grants of hardware, software, technical support staff and maintenance services. These grants will total approximately $50 million dollars over the five year life of the Project. In addition, MIT has undertaken a separate fund-raising initiative to raise $20 million for Athena curriculum development and operating costs.

Who owns the results of Project Athena?

The short answer is MIT. However, any work done by a student who is not being directly paid for that work is owned by the student. MIT is still finalizing the policies under which students working for pay, staff and faculty will share in any economic benefits. A Committee on Software Rights chaired by Professor Michael Dertouzos has recently issued a report on this question. Specific questions can be directed to the Technology Licensing Office at MIT.

What do Digital and IBM get from Project Athena?

The two main corporate sponsors of Project Athena both see the Project as a large-scale laboratory in which they can learn how computing will fit into universities in the future. If Athena is successful, it will serve as a model for how a computer-intensive university might function.

Athena also provides a test bed for new products. In trying to create a coherent environment, we often discover gaps in planned products or identify new hardware and software needs that both companies can factor into product plans.

Both manufacturers also look to MIT to find important ways computing can be used in education.

Neither Digital nor IBM owns any of the software created by Project Athena; that remains MIT's. Furthermore, the grants of hardware for Project Athena's use are gifts, and are owned by MIT even after Athena is over.

Is Athena the only computing resource on campus?

Definitely not. To students, Athena is perhaps the most visible computer system, but it is only one among many. MIT has a number of large mainframe systems run by MIT's Information Systems group, primarily for administrative and research-related users. Various academic departments and laboratories operate their own facilities. There are a large number of personal computers spread out across the campus in faculty and staff offices. Finally, many students own their own computers.

It is important to remember that no one computing environment can be all things to all people. We have designed Athena to serve primarily educational computing needs, with a special emphasis on relatively sophisticated systems and support of curriculum innovation. If support of text processing applications had been our major goal, we would have made very different decisions. You may find some of your computing is better handled by non-Athena facilities.

Does Athena cooperate with other major universities?

The Athena staff works closely with other major university computing projects, including Carnegie-Mellon, Brown and Berkeley. When possible, we try to share software and work together to establish common interfaces. We all share the long term goal of making exchange of applications software between universities easy.

Various faculty curriculum developers also have cooperating arrangements with other universities. For example, the largest single curriculum development project is in the area of foreign language instruction. As part of this project, Middlebury College has agreed to be a test site. Similarly, a major Athena project in Civil Engineering is working closely with a group from Texas A&M.

How Does Athena Affect Me?

What can I use Athena for?

Athena's computing facilities are intended for general educational use. While the most common uses are as part of academic subjects, students may use Athena for undergraduate theses, special projects or other activities that are broadly construed as part of getting an MIT education.

Athena's computing facilities may not be used for externally sponsored research. Research computing should be done on one of the various central or departmental facilities. An exception to this is UROP projects for which there is no funded research; students may request access to Athena hardware for this purpose.

You may not use Athena computing for any commercial purposes. You should also not use Athena in any way that interferes with other peoples' legitimate uses. For example, malicious "hacking" that destroys other students' work or examines other users' files without their permission is a violation of the standards of acceptable behavior for members of the MIT Community. Incidents such as these should be reported to the Athena staff, the Office of the Dean of Student Affairs or, in extreme cases, the Committee on Discipline.

A more detailed description of appropriate (and inappropriate) uses of Athena can be found in a statement, "Principles of Responsible Use." This is widely circulated in Athena work areas.

What are Athena's plans for placing equipment in the MIT living groups?

Each of MIT's living groups is unique, and no single plan could ever apply to each of them. For some groups, having an extensive Athena installation makes sense; for others, it doesn't.

We are now in the pilot phase of putting equipment in living groups. We will have Athena equipment working in five living groups some time during the Fall, 1986 semester. The location, scale and design of each of these installations was tailored to the desires and needs of the individual living groups.

In this pilot phase we hope to learn about the costs, operating problems and effects on student life of having high performance computing available in a living group. That experience will guide future living group installations.

As a matter of policy, we plan to make essentially the same base amount (per student) of equipment available to dormitories and independent living groups, (both on and off campus). Some living groups will be offered the option of a

more computer-intensive environment, and others may choose to have no equipment installed. All of these choices will be custom-tailored in cooperation with the residents of the living groups, faculty residents and the staff of the Office of the Dean of Student Affairs.

Should I buy my own computer now?

There is no simple answer to this. Many of the uses students buy computers for are accommodated by Project Athena. However, Athena's first priority is support of the curriculum. Many students want computers for word processing and find it better to own their own, smaller computer for this purpose.

As Athena expands, it will become more useful for general purposes. Many students have adopted a "wait-and-see" approach. In any case, you should have a clear idea of the things you want to do before buying a computer. Very few students can afford Athena-type workstations at their current prices. You should probably have specific uses (such as text processing) in mind when you decide to purchase a microcomputer.

How does a student get more involved in Project Athena?

Students can become involved in Athena in a variety of ways. Most often, students become Athena users either by using an Athena facility open for general use or by taking a subject that requires use of computing in some way.

This fall, about 80 subjects with a combined enrollment of about 3,100 required use of Athena. Students who find the use of computing interesting often apply for a position on the Athena student staff. Within the staff, students work as consultants, software developers, technical writers, release engineers and operators. This fall, about 52 students were employed by Athena in one of those capacities.

The faculty-run curriculum development projects also involve students, generally as applications programmers. Members of the Student Information Processing Board (SIPB) use Athena equipment and often experiment with new concepts in computing. Many UROP projects and theses use Athena.

Will Athena increase the amount of computer programming in the curriculum?

One of Athena's goals is to make the computer a useful educational tool that doesn't require the student to write computer programs. We encourage curriculum development projects that do this.

Right now, the decision about how much computer programming a student is required to do is left to the individual academic departments, who, with approval

of the Committee on Curricula decide on whether subjects that require programming are part of the departmental requirements. Athena tries not to alter this situation.

What Technology is Athena Using?

What is the definition of an "Athena workstation"?

When Athena was planned we established a working definition of what constitutes an Athena workstation. This definition has evolved somewhat from the original specification and may well change over time as computer technology (and the cost of it) changes. At this point, an Athena workstation is a single user computer with the following characteristics:

- a 32 bit processor capable of executing at least one million instructions per second;
- a high resolution bit mapped graphics display with on the order of one million "pixels" (picture elements);
- a "mouse" that can be used to point at and select among objects on the screen;
- a network communications interface operating at speeds of at least one million bits per second;
- a data storage device (usually a fixed disk drive) with a capacity of at least 30 million bytes;
- dynamic memory of at least 2 million bytes.

These specifications exceed what most people think of as available from today's personal computers. However, many advanced products now on the market meet or exceed these specifications.

Why did Athena choose such high performance technology?

Many of the now-common uses of computers work quite well on less advanced computer hardware. For example, very few text processing applications require the capabilities of Athena workstations. The reason Athena has chosen more advanced computers is the belief that many of the educational applications Athena wants to foster will require sophisticated computation. Software that uses high resolution displays or which makes use of computation-intensive numerical procedures will be important at MIT.

We also envision the linking of Athena's computers through the high speed, campus-wide network at MIT as an important way of facilitating the sharing of information. Isolated personal computers do not provide an environment that makes exchange of information easy.

Why did Athena select UNIX as the base system?

There is no question that UNIX is often frustrating for first-time users. There are times when even sophisticated computer users are bewildered by some of its

idiosyncrasies. In spite of these known shortcomings, UNIX was selected because of its following advantages:

- It has been implemented on an extraordinarily wide range of computer hardware. We can, therefore, adopt it without being committed to any particular vendor.
- UNIX provides support for multiple tasks operating on a single processor. This feature makes it easier to build complicated systems such as window managers, where different applications execute in different portions of a single display.
- The particular version of UNIX we chose, Berkeley UNIX, had a number of technical features Athena needed, including built-in network support for the type of network used heavily at MIT.
- Berkeley UNIX is an "open system". We have the source code and we can modify it as needed to fit our requirements.

What is the "Athena network"?

There really is no such thing as the Athena network. Project Athena's computers are connected to MIT's campus network operated and maintained by the MIT Telecommunications Systems group. This network connects a number of computers together besides Athena's. Because Athena is currently such a large user of the campus network, many people confuse Athena with the campus network.

The Telecommunications Systems group publishes a booklet entitled "Networks at MIT" that describes campus communication's systems.

Can I connect my own personal computer to the campus network?

Right now, the answer is no. MIT living groups are not yet wired in a way that makes this convenient.

Over the next few years, MIT will be installing a completely new telephone system. As part of the rewiring required for this system, the MIT Telecommunications Office is planning to install extra wiring that will make it possible to connect every dorm room and office to the campus data network. This will open the possibility that a student could "hook up" his or her own computer, provided that the computers' hardware and software is compatible with the campus network.

There will probably be a fee for such a connection that reflects the maintenance and operating costs of the network. The details of how all of this might work will be developed over the next year or so.

How is Athena Organized?

How is Project Athena organized?

Because Athena involves industrial participants and many parts of the Institute, its organization is somewhat difficult to explain. It helps to divide the discussion into a few parts:

What is the Athena Executive Committee?

This group is a faculty committee augmented to include representatives from IBM and Digital. It is responsible for providing general policy guidance to the Director of Project Athena. The membership of the committee changes over time. When this handbook was prepared, it included:

Professor James Bruce
Vice President for Information Systems

Professor Michael Dertouzos
Director, Laboratory for Computer Science

Professor Ann Friedlaender
Dean of Humanities and Social Science

Dr. George Champine
Associate Director, Digital

Professor James Kinsey
Chairman of Athena Resource Allocation Committee for School of Architecture and Planning, School of Humanities and Social Science, School of Science, Sloan School of Management and the Freshman Year

Professor Steven Lerman
Director, Project Athena

Professor Margaret MacVicar
Dean for Undergraduate Education

Professor Joel Moses
Head, Department of Electrical Engineering and Computer Science

Professor Earll Murman
Chairman of Athena Resource Allocation Committee for School of Engineering

Mr. Charles Salisbury
Associate Director, IBM

Professor Jerome Saltzer
Technical Director, Project Athena

Professor Gerald Wilson (Chairman)
Dean of Engineering

What are the Resource Allocation Committees?

Proposals requesting funds from Project Athena for curriculum development are reviewed by two Resource Allocation Committees. Projects orginating from the School of Engineering primarily use Digital hardware. Those from other schools and projects affecting freshman year students use IBM hardware. There are separate Resource Allocations Committees for these two parts of MIT.

How is the MIT Staff organized?

The Director of Project Athena, Professor Steven Lerman, is responsible for the overall management of Athena staff. The Assistant Director, William Hogue, is responsible for user services and deployment planning. Decisions involving the technical architecture of the Athena system are made by the Athena Technical Director, Professor Jerome Saltzer.

The Athena staff is organized into five areas each of which is listed along with its respective manager:

Systems Software - Daniel Geer
Applications Software - Mark Levine
User Services - Jacqueline Stewart
Deployment Coordination - Alana Erickson
Office Support - Connie Donaghey

What services are provided to Athena by the MIT Information Systems Staff?

Many of the functions Athena performs are actually done by the staff of Information Systems. This group operates the cable TV system, the MIT phone system, the administrative computers, many central computers used for research and education and the microcomputer center. The two groups (and their respective mangers) within IS that are particularly important to Project Athena are:

Athena Operations - Peter Kelley
Campus Network - Jeffrey Schiller

How do the Industrial Staff participate?

The industrial participants in Project Athena are also appointed as visiting engineers or scientists at MIT. They work as part of the systems and applications

software groups. The senior managers appointed by Digital and IBM are Associate Directors of the Project and members of the Athena Executive Committee.

How does Athena decide who has access to different computing facilities?

As Athena has expanded its facilities, the need for educational computing has increased. For example, in the Fall, 1986 academic term, approximately 80 subjects with a combined enrollment of 3,100 students will use Athena facilities as a required part of the curriculum. These numbers have increased each semester since Fall, 1984 when we first made our computers available for academic use. At the current time, we simply have not been able to install enough equipment to meet all possible needs.

In order to deal with this scarcity, we have tried to separate groups of users with different needs. For example, we have created small areas for the major curriculum development projects to accommodate their needs for almost continuous access to Athena.

Most of our other facilities are allocated to specific subjects. Each semester we survey instructors and inquire about their computing needs. Highest priority is given to faculty who are using software that was developed under Athena funding. This reflects our emphasis on the goal of curriculum innovation.

This priority has had the side effect of making the Student Center, our one facility that has been open to all undergraduates, very crowded. Some of this crowding will persist into the 1986-87 academic year. Our expansion into living groups should help, and we hope to open additional work areas for general use during the year. We also plan to convert the Student Center facility to workstations during the coming year and to double the number of places to work there.

As part of the transition from scarce timesharing system terminals to plentiful workstations, Athena will gradually drop the concept of assigning subjects to specific facilities entirely. Our goal is to make workstations entirely substitutable--you should be able to do any work from any Athena site.

Where is Athena Headed in the Future?

Is anyone studying the effects of Project Athena?

MIT has created a committee called the Project Athena Study Group. This group, chaired by Dean John deMonchaux, makes recommendations to the Provost for specific studies that will better inform the Institute about the effects of Project Athena. Studies now underway include an examination of the deployment of Athena workstations in living groups, case studies of curriculum change in four departments, and an historical study of Athena.

Project Athena has directly sponsored an undergraduate longitudinal survey each semester. This survey provides a profile of Athena use and tracks changes in the ways students use computation. Reports describing the results of these surveys are issued each semester.

Various faculty members often conduct interviews and surveys in the subjects they teach to understand how Athena use is viewed by students.

Finally, aspects of Athena are also the subject of student term papers, theses and UROP projects.

Does MIT have commitments to require students to buy computers in the future?

No. Athena involves neither explicit nor implicit future purchase commitments. MIT will use the experience gained from Athena to make a longer term decision. Requiring students to own computers is only one possible option. (See "What happens when Project Athena is over?")

What happens to the software Athena creates?

One of Athena's goals is to convince computer manufacturers to adopt software we develop. In this way, the maintenance, enhancement and documentation of software becomes the responsibility of experienced vendors rather than the university. This reflects the long tradition of MIT as a place where new ideas are created and tested and made available to the public.

Will the change from Phase I to Phase II hardware happen suddenly?

No. We plan to shift from the Phase I system (consisting of time-sharing VAX's and PC/AT's) to true workstations gradually. This transition will take a full year, and should be virtually complete by September, 1987.

The first group of workstations we provided in September, 1986 do not have all the software available. This "interim workstation system" relies more heavily

on removable storage media (floppy diskettes and tape cartridges) for student's storage than our longer term environment.

We generally try to make any major software changes between semesters. The Athena documentation group releases detailed descriptions of changes, and Athena "minicourses" are offered each semester to describe new software.

What happens when Project Athena is over?

Part of Athena's mission is to provide the experience MIT needs to decide what to do next. For this reason, the simplest answer to this question is "No one knows yet."

The possible options range from phasing out extensive use of computing to finding ways of increasing available computers so that each student has one. In between these two extremes are options such as continuing the operations of a few thousand workstations for educational uses. We may also find that MIT wants to extend the period of study and evaluate Athena a few years before we make a longer term commitment.

We expect a decision on Athena's future to be made around January, 1988. This will allow time for planning any transition.