MIT's Project Athena: A Meeting of the Minds

By Lee White

IBM and Digital Equipment Corp. have gone back to school at Massachusetts Institute of Technology in Cambridge, Mass. This time, though, IBM, DEC and MIT are all learning something new.

MIT needed a solution to a serious problem on its campus: There were computers dotting the terrain, and along with the various pieces of hardware were diverse operating systems, programs, protocols and networks, mostly centered around research activities. A student moving from one computational environment to another, even within the same department, met time and programming barriers that seemed hardly worth the effort to overcome.

As far back as 1979 The MIT Ad Hoc Committee on Future Computational Needs and Resources recommended networking the entire campus and distributing several thousand personal computers by 1989. But it was not until 1982 that the long-range planning efforts of the School of Engineering identified the need for computing resources in each department.

At about the same time, three other developments occurred: the advent of the 32-bit personal computer, which put the power of mainframe computing on the desktop; advances in networking technology; and vendor-awareness of the importance of the educational market.

Professors in the School of Engineering began discussions with major computer manufacturers in late 1982. As negotiations progressed, MIT decided that more than one vendor's participation would ideally simulate the true multivendor environment. In May of 1983, MIT signed a $70-million agreement with Digital Equipment

Corp. and IBM, and Project Athena was born.

Project Athena, named for the Greek goddess of wisdom, differed in many ways from outwardly similar agreements inked by computer manufacturers and universities. For the most part, other pacts involved vendors' donating equipment to educational institutions with the hope that students would become accustomed to particular hardware during their campus days. Those students would influence the purchase of the same equipment after they graduated and entered the work force, vendors gambled.

Project Athena was the first time two big players signed on together for a long-term, side-by-side venture that involved much more than donating hardware. This venture meant the physical presence in adjoining work spaces of IBM and DEC engineers for three years and five years, respectively.

Steven R. Lerman, professor of civil engineering and director of Project Athena, was quick to point out that, although the five DEC and five IBM people talk to each other and have adjacent offices, the relationship between IBM and DEC exists only in the context of a shared relationship with MIT. "In many cases they are working on projects toward common ends — MIT's common ends — but there is no contractual relationship between IBM and DEC, none at all," Lerman explained, adding that their contractual relationship has fairly comparable conditions.

Lerman did, however, comment that each corporation just might have something to gain. "Athena matches some corporate end, but that end is very, very abstract."

For MIT, the end was not at all abstract. Making sense out of the impossible-to-quantify numbers of computers from myriad vendors, most operating in little more than a vacuum, was just one goal. Faculty members who served on the initial task force for Athena were also looking for new ways to teach. The educational environment of the '80s really differed very little from that of 100 years before: Students learned by listening to teachers' presentations of new concepts; by reading books and journals; by working problems and receiving feedback; and by observation, trial and error in the laboratory.

MIT's primary goal, then, was to devise imaginative ways to use computers to enhance and perhaps revolutionize the learning experience. Of the $70 million cost estimate for Project Athena, $25 million each would come from DEC and IBM and $20 million was to be raised by MIT. Most of that $20 million was earmarked for curriculum innovation and design. This money would allow faculty members time to work intensively on their projects. To date, $12.5 million has been raised. At a point less than halfway through the five-year program, more than 70 projects have been funded.

Although a preponderance of the courses deal with various engineering disciplines, a surprising number have originated within the schools of architecture and humanities, with a great deal of input from the Sloan School of Management.

According to Lerman, most of the interesting uses of computers in higher education do not involve using computers as substitute teachers or even as part of direct classroom teaching. Lerman explained that at MIT the average student spends only 12 to 15 hours each week in the classroom, but labors 40 additional hours outside the classroom reading, working in the library, writing papers and working in the laboratory.

As an example of how computers serve as an out-of-classroom aid, Lerman cited a professor who teaches a course in quantitative physiology. Part of the coursework involves teaching mathematical models of the heart-lung system; particular variables include heart rate, pressure in the aorta and oxygen transport across the artery. A standard mathematical model that is traditionally used produces six coupled differential equations. Most students understand the equations at some level but, because the equations are tightly interlinked, have no intuition of how the system really works.

"What the professor has done," Lerman explained, "is to build a software package with graphics. Students can exercise the model system and experiment to see what happens if a drug is administered that decreases the venal pressure or what happens if a drug accelerates the heart beat. They're actually performing 'what-if' experiments on this complicated mathematical formulation. We hope this method will help them develop intuition."

That professors in one of the most distinguished universities in the world could formulate novel methods for educational computing is not surprising. The m complex part of the project, creating common environment so that these n educational methods are available to t entire MIT community, was somethi for which MIT sought outside help. Athena's original planning phase, speci cations were written for a long-term en ronment based upon networked hig performance advanced workstations wi graphics capabilities. At the time, neith IBM nor DEC had built such a device, ar it was decided that Phase I would revol around existing hardware to build a proximations of the future environment.

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Unfortunately, asynchroniz tion has been the order of th day for the hardware side c the project. DEC has ar nounced and is shipping its Microvax I and, with a high-end display, the Micro vax II matches MIT's specifications. IBM on the other hand, has not announced a appropriate advanced workstation. Phas I has therefore consisted of lightly load ed VAX machines on the DEC side. Th IBM side, after a number of desig changes, uses Personal Computer AT and XTs on a network with a uniform software environment and graphics dis plays. At present, the equipment include about 53 VAX units, 160 PC ATs and few Microvaxes for experimentation.

The single integrated network tha ties the hardware together serves abou seven or eight local-area networks. Thi network is two-tiered, with local Ether nets and a backbone network that link them together with a gateway between The gateway, which is transparent to th user, operates with a single protocol.

With incompatibility looming large i the industry, MIT may well be blazing new trails for the coherence it hopes to attain. Lerman called this coherence "a fairly grandiose objective," admitting that MIT will not necessarily be able to drive the industry. "Neither IBM no DEC nor any other manufacturer is obli gated to follow the way we're headed, bu we hope to demonstrate the value of tha sort of environment," he said. If the pro ject is as successful as the Athena com mittee expects, the results will demon strate that hardware from different vendors can be integrated in a manner that exploits the relative advantages o

each, while passing on the benefits of a uniform computing environment to programmers and users.

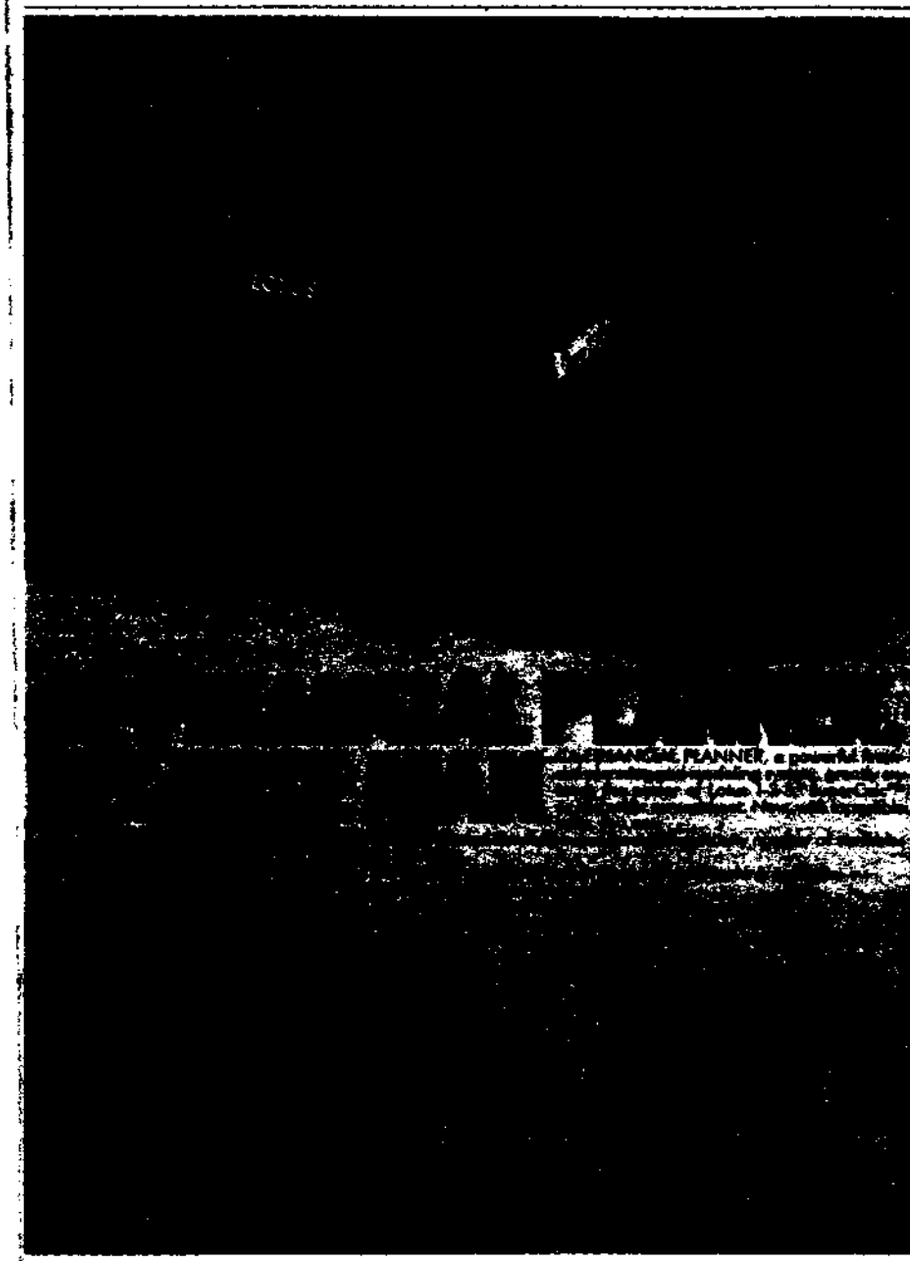
"We're talking about a university environment that is heavily oriented toward people and activities that are research-, teaching- or learning-oriented. To the extent these attributes can be generalized, then they can be transferred to other environments."

Robert V. Mazza, IBM

The heart of Project Athena, however, is not hardware but software. The two workstations presently run different software operating systems: the VAX machines run Berkeley Unix and the PC ATs (and XTs) run PC-DOS 3.0. The data communications protocols are written so that files can be moved freely between the two systems. Nevertheless, the team is headed toward a higher plane of compatibility. "We have prototype software that allows a VAX to provide disk space to a PC AT or PC XT. The PC issues an order to spin up the disk over the network. The VAX is hooked to the same network, and it recognizes the name of the person using the disk and accepts a password access. In effect, you have another PC disk, an E disk. You have the total illusion of having another hard disk, except that it really exists over the network and the VAX is providing it," Lerman explained.

DEC seems to be running ahead of IBM at this time, with its workstations and software actually driving the project, but Lerman hopes that gap will narrow soon.

At the beginning, DEC had its VAX units running Berkeley Unix, but lacked a high-performance workstation. IBM, with its PC AT, had a reasonable workstation, but could not run Berkeley Unix. In Phase 2, when common features of workstations will include a 32-bit processor, a high-resolution bit-mapped display and a local-area network, the theory is that both these problems will be resolved. Much of the uncertainty that exists now is due to IBM's slowness in coming up with a product.



Lerman would not comment officially on IBM's plans for an advanced workstation running Unix, stating instead that discussions are ongoing. He also said the Athena group and IBM were talking about the possibility of experimenting with an unannounced product. "The discussions are quite clear and moving in a certain direction. Part of the [antitrust agreement] issues were that [IBM] was restricted to only announcing things to which they were committed absolutely. So they're very conservative," Lerman said.

With $50 million riding on the project, IBM and DEC might be suspected of having underlying motives that go beyond sheer altruism and the quest for new ways to learn. Jack McCready, manager of External Research Programs for DEC, explained in the best corporate manner that DEC has a long-standing tradition of interaction with universities; he cited approximately 200 DEC-sponsored projects at more than 75 universities in recent years. McCready admitted, however, that Project Athena is certainly the largest project DEC has sponsored, and a first for its coinvolvement with IBM.

McCready's background lends itself well to his job. Prior to joining DEC in September 1984, he spent five years as president of Educom, a nonprofit consortium of 500 universities dedicated to looking at how colleges and universities use computing.

Before Educom, he was vice-provost for computing at Carnegie-Mellon University in Pittsburgh. While at Carnegie-Mellon in 1976, he negotiated a large three-year pact with DEC.

McCready stated that DEC has the best program of university involvement in the industry. "It's a long-standing commitment going back many years and a general success story in that we believe that working with research organizations in higher education is an excellent way to learn about computer information processing-related technology." Regarding Athena in particular, McCready stated that he thought the project could give birth to a new model of computing that might very well take over entire education and commercial accounts over the next few years.

This commercial applicability of Project Athena was not lost on McCready.

Although predicting potential marketability of basic research is difficult, the educational community itself is a huge customer base for DEC, he explained, and accounts for several hundred million dollars each year. This dollar figure will increase as the price of the technology drops and the individual student and faculty workstation becomes a viable alternative to center-based computing.

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Jack McCready, Digital Equipment Corp.

In addition, DEC sees itself as a networking company, and networking is what Project Athena is all about. "[Athena] is probably going to be one of the biggest experimental utilizations. We will be able to learn a tremendous amount about the use of our products in a very large networking case, not hundreds of machines but thousands of machines. That has a direct commercial spinoff for us," McCready said.

Whether this spinoff is in the back of IBM's mind is a subject Robert V. Mazz director of development for Academic I formation Systems at IBM was less i clined to discuss. "Clearly, we're talki about a university environment that heavily oriented toward people and acti ties that are research-, teaching- or lear ing-oriented. To the extent these att butes can be generalized, then they c be transferred to other environments."

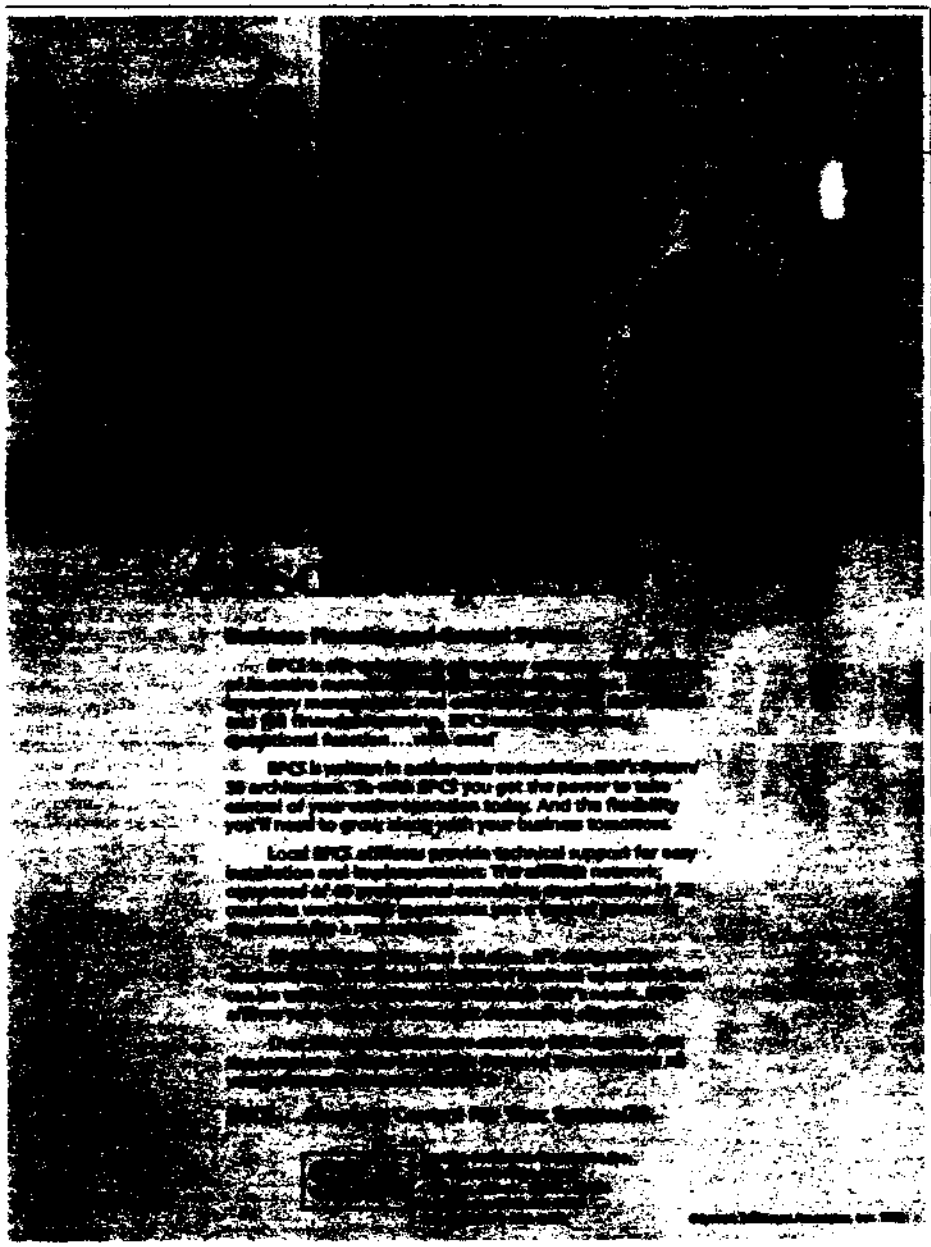
But Mazza expressed doubt th much would be gleaned fro Athena that would be relevan outside the groves of academ He characterized the IBM/DEC activi at MIT as a system interconnect and pr gramming architecture and a user an application interface defined by that env ronment. "It isn't as though we're lasing in our architectures, nor is DE bringing in its architectures," explains Mazza. He added that he didn't think th goals of Project Athena had anything t do with evolving communications, pro grams or applications interface stan dards. If such standards were a byprod uct of Athena, Mazza concluded, "i would be highly surprising to me an would certainly be an unexpected bene fit."

IBM's view notwithstanding, perhaps the most important result will be that o the DEC/IBM connectivity. When Num ber One and Number Two join forces, th potential market value of the result could be staggering. "We see environ ments out there where DEC and IBM sys tems have got to work together smoothl and that is the whole notion of coherenc at MIT. IBM systems and DEC systems networks of them, lots of them all work ing in a common environment," under stated DEC's McCready.

Although present installations includ ing both DEC and IBM systems stand t reap great benefits from a coherent tech nological breakthrough, the question o further narrowing the hardware vendo field would seem to be more probability than possibility. McCready insisted tha the open environment of Athena would have broadening rather than narrowing results, but one would expect that IBM and DEC will have a substantial head start on commercial applications.

MIT's Lerman explained that any and all results of the Athena project will b owned solely by the university and the will be disseminated free of charge to oth er universities.

However, IBM and DEC don't have to worry about being left out in the cold. "The principle we're working on, although it's not embedded in contractual language, is what I would call the most-fa vored-nation principle. We will not make deals with third parties other than DEC or IBM that are better than we would make with DEC and IBM. We would like to create it at MIT and then convince [IBM and DEC] to build it as products. We're not in the support or the maintenance business; that really should be the realm of computer vendors and software houses. Our hope is that they come to us and say, 'Gee, that worked very well and we want to license all this stuff from you and build it.' "



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