ABSTRACT: Administrative Workstation Project at Indiana University

Efforts to sell the information technology vision are plagued by the fact that network infrastructure initiatives require huge investments from the campus during a financially bleak decade. However, this needn't always be the case. The confluence of budget woes and an information explosion created a unique opportunity for Indiana University to sell the information technology vision in 1990. A generous grant from the Apple Corporation enabled us to place Macintoshes and a suite of software on the desks of key campus administrators, and undertake an ambitious project of technological integration into administrative life. The project, dubbed "Administrative Workstation Project", increased knowledge and use of the information technology by key administrators, resulting in greater creativity and productivity in the management function, and improved attitudes toward information technology.
Overview

During the 1980s Indiana University experienced an information explosion similar to that experienced at other colleges and universities. Coupled with this situation was the physical growth of Indiana University's eight campuses, and the increasing importance of university-wide administrative functions that were more cost-efficient. Together these factors spawned an awareness of the need to apply technology to administrative intracampus and intercampus office coordination and administrative functions.

In Spring of 1990, Indiana University administrators in the Finance and Administration division chose to undertake an all-encompassing project, integrating technology into the daily routine of their administrative offices. Earlier piecemeal efforts to integrate technology had resulted in diverse and often incompatible computing platforms within the offices reporting directly to the Vice President for Finance and Administration. Consequently, these offices were characterized by a wide-range of both technical sophistication (from technologically-sophisticated to two-finger typists who described themselves as computer phobics), and commitment to information technology as a viable solution to executive office management.

Indiana University's University Computing Services and Management Advisory Services divisions were charged with developing a project, labeled the "Administrative Workstation Project." The goals for the project included enhancing the computing environment for university executives, increasing knowledge and use of the technology by these executives, increasing creativity and productivity in the university administration function, and improving executive attitudes toward technology. In recognition of the potential costliness of this project, hardware vendors were asked to submit proposals and cost evaluations. Three were obtained by July.

The project team met for the first time in early August. The core team included members of the educational, support, information services, and workstations staff of University Computing Services, but was purposely kept small for greater flexibility. It was agreed that the key to achieving the project goals was to sell the importance of information technology to the executives. In turn, by enhancing the computing environment in executive offices, and increasing these individuals' knowledge and use of technology, the status of information technology at Indiana University would increase. Functional roles were outlined for the team members and personnel resources estimates were calculated. The project team was instructed to solicit help from other staff members on an as-needed basis. Subsequently, a member of the network staff was added to the project team in recognition of the central role of network technology in the success of the project.

By the end of August, the technical and financial analyses of the proposals were complete; a functional analysis of the computing needs of the administrative offices in Finance and Administration was also prepared. Of the three responding vendors, Apple Corporation's proposal for the project was accepted. The Administrative Workstation Project proposal was reviewed by senior management of the computing center, and 29 executives and their assistants were selected as project participants. Roughly eleven months later, the formal project concluded on June 30, 1991. Judging from the participants' evaluations, the project has been quite successful. A number of executives who were once self-described computer-illiterates, now expressed enthusiasm about their Macintosh capabilities. Indicators like the aforementioned example suggest increased
computer knowledge among the participants, the result of which was greater productivity and a more positive response to the information technology vision.
In this section, we detail the key components (ease of use, incremental, specialized instruction, consistency, access, security, support) of the strategy used by the project team to achieve project goals and promote the importance of information technology.

Ease of Use: Given the action-oriented workstyle of the executives, any technology introduced into the office environment had to be easy to use. An intuitive interface, along with incremental, specialized instruction, was critical in meeting this requirement. "Ease of use" also dictated that ergonomic principles be employed in the design of the environment. Apple Macintoshes provided the intuitive interface.

Incremental, Specialized Instruction: Executives are unlikely to attend mass training activities for the general staff. What was needed instead was an exclusive training program with incremental, specialized instruction. An "Administrative Workstation Education Series" was developed by the University Computing Services Education Program staff, and throughout the late fall and spring, project participants attended a variety of weekly instructional sessions.

Consistency: Unlike Indiana University's computing center staff, the executives did not value or thrive on an ever-changing technology environment. Priorities and responsibilities in the executive environment are often in flux, and it is vital that support technology be reliable and consistent. The project team met the consistency requirement in four ways. First, the functionality that the participants had before the project began was equal to, or greater than, functionality they achieved afterwards. Second, consistency with University technology standards was maintained so as not to leave the Finance and Administration executives "stranded" on a hardware and software island. Third, consistency was maintained between the computing environment of the senior executives and that of their staff by including key administrative assistants in the project. Fourth, consistency was maintained between the DOS environments found in the majority of the participating administrative offices and the new Macintosh environment.

Access: Both administrators and their staff required access to the same data on a centralized resource. Consequently, the following steps were taken: an "Administrative Workstation Project" server was purchased as part of the project; a Local Area Network (LAN) administrator was identified from one of the participating offices; project participants received training on server technology, and by December the project participants created their monthly reports using server technology.

Security: One of the first concerns that executives in higher education have about a new technology is security. It was important to demonstrate to the participating executives that security could be maintained at existing levels, or even enhanced. The security requirement meant ensuring that the accounts and data of project participants would be protected, by limiting access to designated personnel. This requirement also necessitated that administrators and their assistants have the ability to recover from any possible system and data loss that might occur.

Support: Project participants needed access to qualified technicians during the transition period between the old technology environment and the new. As part of the grant, Apple Corporation provided funding for part-time support personnel to assist the 29 administrators during the typical 4 hour week. Every effort was made to hire support staff who were critical thinkers, who could verbalize
technical problems at a level appropriate for a wide-range of users, who were aware of technological alternatives, and who would allow the project participants to make their own decisions. The requirement that the hourly staff respect the confidentiality requirements of these executive offices was also of primary importance.
Progress Toward Project Goals

The project was undertaken with five primary goals in mind: the enhancement of the administrative computing environment, the technological transformation of administrative office functions, an increase in administrative knowledge of and comfort with technology, an increase in the use of diverse applications, and the promotion of a distributed computing environment. Progress toward these goals was extremely good.

Enhanced Administrative Computing Environment The project placed mid-range Macintosh computers with a suite of software on the desks of 29 executives and their assistants in the finance administration area. These Macs replaced an assortment of aging DOS microcomputers and terminals with unsupported software. The standard workstation selected was the Mac IIci with 8 MB RAM, an 80 MB hard drive, ethernet card and an Apple 13" monitor. Ethernet LANs were established in each office or series of offices with an EmPac 80486 Novell file server having 660 MB of hard disk and several LaserWriter INIT printers. Each workstation had access to the IBM administrative mainframe using TN3270 and the academic VAX Cluster using Telnet. Mac Powerbooks were furnished for home use, and Timbuktu Remote with NEC 9600 baud modems were used to dial-in to the mainframes and LAN services. Software provided was Aldus Persuasion, MacDraw II, Excel, WordPerfect, Access PC, FileMaker Pro and Address Book.

Technological Transformation of Administrative Functions: The project sought to create a positive technological environment by utilizing LAN-based technologies to transform the way that university business was conducted, and provide a stimulating environment in which to work. Participants were interviewed upon completion of the project to evaluate the success of this aspect.

Many reported that their style of interacting with one another had changed, and that this had resulted in greater efficiency. For example, one administrator commented that use of the technology redistributed the typical workload of his office, and that by using the server in concert with his assistant, participation in many projects increased. The application of technology dearly had the effect of reducing barriers to work-related interactions, e.g., diminishing the importance of physical presence. As communication could occur regardless of separation by distance or time, productivity under these traditionally prohibitive circumstances was now unhindered.

One application cited as a significant timesaver was the electronic telephone log. Assistants receiving phone calls replaced a paper telephone log with an electronic one, which greatly simplified searching for earlier calls. Another administrator enjoyed being able to work from home during evenings and weekends with the same tools that were available in the office. In both cases, greater productivity was the result.

Participants also exhibited an increased sense of autonomy. Administrators learned that they could create their own memos while their thoughts were still fresh, then send the draft to their assistants in preparation for a final copy. Both administrators and their assistants became more independent computists, relying more on their individualized abilities and networking efforts with co-workers, rather than the University Computing Services Help Desk.

Both creativity and autonomy were greatly increased over the course of the project. One example cited repeatedly as a positive outcome was the ability to create material for papers and presentations using graphics. Other examples included the use of network services and an increased motivation to migrate from
formerly non-standard software to strategic technologies. Prior to the implementation of the project, these technological innovations were little understood; as a result of the project, they became a
way of life for those involved. There was, of course, some variance in opinion. A few participants commented on the richness of the Macintosh environment, but maintained a preference of the more familiar realm of Windows environments. In one case, server problems put a damper on use of the entire system for a one week period.

In all, the general orientation of project participants underwent what might best be described as a paradigm shift. This is well illustrated by the following executive's comment centering around the replacement of a Macintosh "desktop" for a physical desktop: "I arrive in the morning, set up my desktop with mail and applications, jump in and out of applications, and generally have shifted my focus from paper to the workstation."

Increased Knowledge of and Comfort with Technology: Without exception, project participants reported that they were more knowledgeable about computing and information technology as a result of the project. One administrator commented that he felt his office was on the cutting edge of administrative computing. In general, attitudes about computing moved from ones of trepidation or ignorance, to ones of increased confidence and comfort in using the computer to accomplish more and better work.

The associated Administrative Education Series was the primary vehicle for assisting the project participants with acquiring more knowledge about the technology, and was rated by the majority of participants as "outstanding", and as "satisfactory" by the remainder. Generally speaking, prior DOS users were impressed with the user-friendliness of the Macintosh. Many project participants felt that the educational series was key in enabling them to use a variety of technological applications more frequently, and with greater ease.

Use of More Diverse Applications: Another of our primary goals was an increase in the use of diverse applications by project participants.

Enhanced Distributing Information Environment Overall, users who were operating in a Mainframe-Based, Terminal-Oriented Computing Environment were able to migrate to a more user-friendly Workstation-Based, Network-Oriented Computing Environment. Commitment to the technology postproject was evident by the hiring of LAN administrators by several of the participating departments.

Things We Would Do Differently

The vast majority of things that we would do differently fall under the heading of inclusion. In general, we would include as many individuals as possible to avoid any sense of exclusionary practices. We failed to recognize that the project would be perceived as a high-status project because it involved top executives in the university. As a result of this perception, more individuals sought to be included in the project than our personnel resources could handle. In retrospect, we should have begun the project by identifying any computing support staff from the departments participating in the project, and inviting them to join the project team. We should have also included computing center staff members who thought they were making a major contribution to the project. Finally, we should have included assistants to the assistants of executives, if available funds allowed for this.

Another area in need of improvement involved timing. First, we would spread out the installation time period. The hourly assistants worked 80-hour weeks during the installation period, as did many other members of the project team. In addition, we were forced to ask Communication Services to put our project ahead
of others in order to get data jacks installed in a timely manner. Communication Services graciously agreed to assist, but we should not ask that of them twice. Second, we would change the timing of workshops. The workshops should be bi-weekly or monthly, but not weekly. It was our
experience that project participants cannot assimilate the new tools and maintain their current workload if the workshops are scheduled too closely. Third, we would change the timing of the introduction of specialized functionality. Project team efforts were wasted on providing instruction on "bells and whistles" prematurely. The time to introduce bells and whistles is after basic functionality is achieved.

Another set of things we would do differently involves negotiations. Next time, we would negotiate with the project participants to be partners with the project team in the goal to make them more independent computists. This must become a shared goal. We would also negotiate with the participants about support issues for the year following the project BEFORE the project starts. This would allow administrative units sufficient time to budget for any additional personnel costs they might incur. We would also negotiate in advance as to what constitutes a "crisis." Team members and project participants had different definitions of a crisis. In the future, we would advise that if the project team and computing center will not be available 24 hours per day, seven days a week to handle support issues, to make that known in advance. Identify the hours when project team members are available and stick to these hours rather than give the false impression that support is available around the clock.

All projects have obstacles. If we had it to do over, we would identify our potential points of vulnerability from the onset, that is, we would attempt to predict the obstacles to project success. In retrospect, we recognize that the newest technology will be our greatest area of project vulnerability, regardless of the technology and regardless of the project. The newest technology introduced to the group was Local Area Network (LAN) technology.

There are many things we would do differently in the LAN area. We would identify a LAN administrator from the participating offices at the beginning of the project. Moreover, we would assign a project team member to help the administrator develop policies and let the LAN administrator enforce the policies from the beginning. We would then work with the LAN administrator to develop an organizational structure for the server prior to placing participants on the server. The server environment served ten different departments, all with different notions of a filing structure. Consequently, the server took on a structure analogous to allowing 29 library patrons to organize the shelving scheme of the public library. We would develop a LAN/server policy early on in the project. Political considerations dictated server policies in the early days of the project because a policy did not exist. Once the "de-facto" policy took shape, it was difficult to implement new regulations.

Still another area in need of revision is that of training. First, we would group the participants in the mandatory introductory classes, basing the grouping on past computing experience. An individual who is new to computing is very different from an individual who is new to a platform. We knew that, but we thought that keeping the group of executives together was more important than ability grouping. It is not. Second, if we had it to do over again we would provide classes in one dedicated, state-of-the-art training site. This would make it possible to have more stable training in a real classroom environment with much less effort on the part of the Education Program staff, as well as giving executives a better impression of our campus computer classroom environments. Third, we would plan differently for the training component. We would have the training coordinator meet with representative(s) from the participating offices to clarify their training preferences, to be sure the right questions are asked and right answers given for rationale behind the training.
Finally, there is the category of oversights. If we had it to do over we would include network factors in the platform decision. Given the campus goal for distributed computing, a platform cannot be evaluated outside the context of network issues such as file sharing, remote access, and the state of the deployment of the network. In future projects, the networks staff of the computing center should be
involved in the original evaluation of vendor proposals. Further, we would resolve the workstation platform compatibility problem head-on and make this an objective for a project team member. Our executives did not work in isolation. As a result of the grant from Apple, many of our executives now had platforms that differed from the majority of their staff. We would provide training and/or documentation on the subject of successfully migrating from one platform to the other.

The Future Distributed Computing Environment (DCE) for Executives

Since the project formally ended, a new executive service environment has been conceptualized and developed. The Indiana University Distributed Computing Environment (DCE) is a service environment in which students, faculty and staff have transparent access to a full range of network-based services and information. Access to the DCE is provided by a variety of computers, through the single access point of a desktop computer featuring a graphical user interface. The client/server cooperative processing paradigm is utilized to deliver services directly to the workstation user.

The Distributed Computing Environment includes and integrates four network service domains:

1. Personal: The sharing of one's personal workstation resources with users at similar workstations.

2. Workgroup: Systematic group-level sharing of applications, data files, printers and other peripherals among the workstation users in a workgroup or department.

3. Campus/University: Systematic, ubiquitous access to University data, computing, communications, storage, application, and peripheral resources provided by University-wide agencies.

4. Internet Evolving access to the world-wide information holdings of organizations on the Internet.

The DCE and the Administrative Workstation Project

As described in earlier sections of this paper, the project resulted in the establishment of a vigorous and widely used workgroup network service domain. All Macintoshes were equipped with Ethernet adapters. Utilizing EtherTalk technology (AppleTalk protocols over an Ethernet data link layer), data and applications were shared among project participants through a Novell server equipped with the NetWare for Macintosh NLM (NetWare Loadable Module, and add-on to basic NetWare). Standard AppleTalk printer sharing was supported, with Dayna EtherPrint devices connecting the shared LaserWriters to the Ethernet.

Project participants were also introduced to the personal network services supported by the 7.0 version of the Macintosh operating system such as File Sharing and program linking.

At the time of the project, access to the Campus/University service domain was obtained through traditional timesharing, not distributed computing. The Macintoshes were equipped with a telnet (the standard TCP/IP terminal emulation application) featuring both vt100 and 327x terminal emulation. Project participants accessed University information and messaging services through terminal sessions with University mainframes.
This project experience illustrates well the bi-modal nature of Indiana University computer service delivery in recent years. Personal and workgroup applications and services have evolved as local and native workstation services; campus-specific, university-wide, and remote applications and services have remained mainframe-based, with access typified primarily by terminal sessions, and secondarily by file transfer.
Indiana University has begun a deliberate effort to shift from this dual mode of computer service delivery to a single, unified mode through which central services are provided as network-based, client/server applications delivered transparently to, and fully integrated with, the desktop computing environment. The new client/server applications will be provided for DOS (initially), DOS/Windows, Unix/Motif, and Macintosh workstations.

The New Executive Service Environment

Generic messaging services will be workstation-based. We have deployed workstation mail based on the POP (Post Office) and SMTP (Simple Mail Transfer) Protocols, and Usenet News readers based on the NNTP (Network News Transfer) Protocol. We have also begun a project for a distributed conferencing system.

Generic information access services will be workstation-based. We have transferred our Campus Wide Information System — our campus’ computer-mediated mechanism for the selection and delivery of information and services — to the desktop environment. Based on a transitional protocol implemented over TCP/IP, the system, WISE (Workstation Information Service Environment), will evolve to a standard protocol (e.g., 239.50) when a standard emerges.

Additionally, we have begun implementing a series of information applications based upon distributed relational database technologies. Typical applications in this category include the University Register, Events Calendar and Address Book. Our initial distributed database product is Ingres, used in conjunction with the Integrated Development Environment and PolyServer network data access products from the Uniface Corporation.

New administrative systems will also be workstation-based. Among them is a new Financial Information System. Within this application and others, the salient characteristic will become "work flow" rather than "transaction processing". Open, standards-based computing platforms with full TCP/IP connectivity are the targeted server systems for these applications. To support access to legacy data from the new applications, we have been evaluating technologies which provide access to IBM VSAM data from our distributed database client/server domain.

Finally, ad hoc query and reporting tools will be workstation-based. We are just completing a project that has identified Data Prism from Brio Technology as the standard desktop data access tool for the Macintosh. Q+E from Pioneer Software is the leading contender for DOS/Windows. An Ingres-DB2 gateway provides access to legacy data on the IBM/MVS mainframe from the desktop query environment.

A combination of specially-designated desktop data access tools that provides views of data and data access applications will provide a functionality commonly termed an "Executive Information System." Delivery is predicated on the basis of an ever-growing and increasingly powerful installed base of workstations, and deployment of a ubiquitous high-speed University network.

The implementation of the above is made possible by a prior implementation of network authentication services (Kerberos); directory services (Berkeley Name Domain Service and Hesiod; X.500 experimentation begun); time services (Network Time Protocol); standard compilers (ANSIC); standard Transport Layer Interface (Berkeley sockets); standard network protocols (TCP/IP); and standard user interface toolkits (Macintosh, Motif, C-Scape for DOS; Windows toolkit TBD).
Why is this our strategic direction?

The ability to access the information and services of a variety of computers is quickly becoming a necessity in higher education. Using the workstation as a service portal is the best way to provide services from a wide array of sources. Delivery is through a single, familiar local environment featuring Graphical User Interfaces (GUI) with point-and-click service selection, allowing for complete personal access to services regardless of the placement of services on the network, or the user's location.

The client/server model supports optimum utilization of network computing resources by identifying the computer best suited for a particular task, and processing within that station's specially-designed applications. Thus, the client workstation moves beyond the stage of terminal emulation to the maximum utilization of all capabilities. This is especially critical given the millions/tens-of-millions of dollars the typical institution has invested in desktop computers. All computing platforms, regardless of vendor origin, can and should be fully utilized and integrated.