MEASURING QUALITY, COST, AND VALUE OF IT SERVICES

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SUMMARY
For the last decade, University Information Technology Services (UITS) at Indiana University has measured the satisfaction of its customers – students, faculty, and staff – with the IT services its members produced for the university community. It has used the results of these surveys to improve the range and quality of services it offers. For the last five years Activity Based Costing measures have been applied to all IT services produced by UITS. Through major organizational realignment, profound cultural changes, and the rapid evolution in hardware, software, and network technologies, UITS has pursued quality improvement, process improvement, and implementation of the Balanced Scorecard family of measures. We discuss the journey thus far with special reference to the ways in which support services are critical to the realization of full value of IT services by our customers.

INTRODUCTION
Thirty years ago the Statistical Package for the Social Sciences (SPSS) ran on the mainframe and the computer center devoted one person, more or less, in support of the program and its users. Back then, SPSS came with a manual of about 200 printed pages. This manual not only told the user how to use the program but also actually taught the user about statistics and provided a guide to their appropriate use. Today SPSS runs on most PCs and has a manual of over 700 pages. The manual has expanded in size in proportion to the number of tests and procedures that have been added to SPSS. The manual still teaches about statistics and how to interpret the results of statistical measures. The computer center still has one or two people to support the program and its users.
Today Microsoft Word runs on the PC and the commercially produced manual for it is more than 700 pages long. The "dummies" version of the manual is almost 400 pages long. Neither manual teaches one how to write, only how to use the program.

The fact that a word processing program that replaces pencil, pen, or typewriter has a 700-page manual that teaches nothing about writing suggests there is something amiss. The program is exceedingly complex – feature-laden and bloated – and one must plow through scores of pages to learn how to use it: actually to learn how to avoid most of its features so that the business of writing can proceed.

If, in bygone days, one person could support a complex program with a brief, instructive manual of 200 pages and a few score users, then how many persons does it take to support many programs that have opaque manuals of over 700 pages and tens of thousands of users?

The answer to that question and a narrative of how one maintains the quality of that support are the topics of this paper.

BACKGROUND

Indiana University is not a university system but a spatially distributed university with eight campuses and several learning centers. As a whole, approximately 4,000 full time faculty, 2,000 part-time faculty, and 10,000 appointed staff serve 92,000 students. The campuses of Indiana University range in size from approximately 2,200 students at the East campus in Richmond and 2,600 students in Kokomo, to 4,700 students at the Northwest campus in Gary and 5,900 students at Ft. Wayne, to 6,100 students on the Southeast campus in New Albany and 7,000 students in South Bend. These smaller campuses offer courses in the liberal arts and sciences, business, nursing, education, and the applied sciences to students who are tied to their locality by job, family, or inclination. In the Carnegie Classification they range from Baccalaureate II through Master's I institutions.

The core campuses of Indiana University comprise the urban, Indianapolis campus, IUPUI, and the residential campus in Bloomington. IUPUI, which includes the Indiana University Medical School, offers Indiana University programs in the arts and sciences, medicine, nursing, law, business, and public and environmental affairs plus Purdue University programs in engineering and some sciences (hence Indiana University Purdue University Indianapolis). IUPUI enrolls approximately 14,500 full-time and 13,000 part-time students. It employs approximately 1,700 full-time and 750 part-time faculty and 3,700 staff. IUPUI is a Doctoral II institution in the Carnegie Classification.

The Bloomington campus is a traditional, Big 10 residential campus. A Research I institution in the Carnegie Classification, it offers the full range of graduate programs in the arts and sciences, law, library and information sciences, health and recreation, public and environmental affairs, education and journalism. It has approximately 36,000 students, 1,600 full-time and 250 part-time faculty, and 4,900 appointed staff.

The campuses of Indiana University stretch the length and breadth of the State: from Gary, on lake Michigan in the northwest, to New Albany, on the Ohio River in the southeast. Indiana University takes pride in the fact that more than 80 percent of the Indiana population lives within 50 miles of an IU campus or learning center. The spatial extent and organizational variety of these campuses and their communities present management challenges, not only for administrative and academic programs, but for the information technology organization that serves many of their common IT needs. Today, the various digital networks that make up IUNet provide video, data, and voice services and other IT services that help bind a dozen locations into one university.
UNIVERSITY INFORMATION TECHNOLOGY SERVICES: QUALITY CULTURE, QUALITY ORGANIZATION

The development of systematic quality improvement, customer based satisfaction measures, and the deployment of the Balanced Scorecard family of metrics (Kaplan and Norton 1996) is an integral part of the development of University Information Technology Services (UITS) at Indiana University. Today, this organization, which employs 500 full-time and 500 part-time (for the most part student) personnel, serves many of the IT requirements for the entire university. With a budget of more than $70M, UITS offers Inter- and Intranet services, including video services, for the entire university; it produces administrative, library, and other mission-critical applications for all campuses; it offers many IT support activities for the university, including support for High Performance Computing and other research computing services on the smaller campuses. In Indianapolis, UITS also provides telephone and media services, research and academic computing, some student computing facilities, and full service support for all these services. In Bloomington, UITS provides all IT services, including service to the Halls of Residence and Family Housing. Finally, UITS and Indiana University is home to the GlobalNOC that manages the Internet2 Abilene Network, the AsiaPacific TransPAC Network, other international networks, and their interconnections at the STARTAP in Chicago.

The nucleus of UITS was formed when administrative computing and Bloomington Academic Computing Services were combined in 1989 to form University Computing Services. The new organization had responsibility for administrative and library applications on the eight campuses and academic and student computing on the Bloomington campus. It also had responsibility for the Bloomington campus network and the inter-campus network, both of which had just begun to employ Internet protocols (TCP/IP) in addition to IBM's System Network Architecture (SNA) and other protocols like X.25. The organizational and cultural changes required by this merger were acute: an extremely hierarchical organization, with a few perceived customers, such as the bursar and registrar, was forced together with an organization that had a few score faculty and graduate student users and had the ethos and organization of an academic department. Over the next two years, with the completion of the campus network, the advent of the universal student computing accounts, and universal e-mail, the number of users went from a few hundred to tens of thousands.

Strategic plans for the new organization included a massive expansion of student computing facilities, ubiquitous computing services for students, faculty, and staff, and the development of a robust IT support organization. An inventory of services was prepared, and it turned out to be a confusion of applications, machines, and operating systems. A census of customers was taken, and it became clear that little was known about the IT needs, requirements, prowess, and use by students, faculty, and staff on the Bloomington campus. The UCS user computing survey, which was instituted in 1990-1991 (much more on this topic below), had three explicit goals: 1) to gain some knowledge of the individuals who used the IT services; 2) to measure their satisfaction with these services; and 3) to focus UCS personnel on the fact that we were an organization that provided services, not particular network protocols, operating systems, and hardware.

After five years of mutual adjustment and the growth of the organization and its customer base to current levels, the implicit structure remained a bit hierarchical and a bit academic/departmental. If there was a master trope for the organization it was one that focused on specific hardware platforms and their operating systems. As a result several groups "owned" e-mail, and neither they nor their systems spoke easily with one another. Other groups fought to retain a particular combination of hardware and operating system rather than improve the services they produced through a change in both.
In 1995-1996, three initiatives were taken to focus the organization completely on services and on customer satisfaction with these services. First, UCS was explicitly reorganized around specific services and the small teams that produced these services. Second, Activity Based Costing (Shank and Govindarajan 1993) was instituted for each service. Third, elements of the Balanced Scorecard (Kaplan and Norton 1996) were adopted for each team and service and for the organization as a whole. Thus each team focused on the cost and quality of the services it produced as well as on both its internal and external customers. Each team controlled the budget for their hardware and software, had a major voice in performance reviews of their individual and collective work, and controlled the budget for their training, travel, and personal technology. Each team was responsible for mapping its internal processes, showing where these processes met with those of other teams, and showing how the parts combined to produce services for the students, faculty, and staff of Indiana University.

The Office of the Vice President for Information Technology and CIO for Indiana University was established in 1997. The elevation of this office to the President’s Cabinet gave a single point of focus and leadership for IT at Indiana University. The UCS organization on the Bloomington campus was combined with Integrated Technologies on the Indianapolis campus to form University Information Technology Services. A divisional structure was established for UITS – Teaching and Learning, Telecommunications, University Information Systems, Research and Academic Computing – and the new organization was given responsibility for IT services on both campuses and support for IT throughout the university. The team and service structure and focus was retained within and among these four divisions. The user satisfaction survey and Activity Based Costing were extended to services offered on the Indianapolis campus. In 2002 the full measure of the Balanced Scorecard (Kaplan and Cooper 1998, Kaplan and Norton 2001) will be extended to IT services on all campuses of the university.

At least two lessons have been learned during this process of continuous organizational renewal. First, it is difficult but not impossible to create an organization of teams from either a hierarchical, command and control organization or a group of individualistic entrepreneurs. Second, it is difficult to shift the focus of a university IT organization from particular technologies to the services these technologies produce. The only way to accomplish the latter is to make the former responsible for the quality and cost of their services and the conservation and renewal of their intellectual capital.

COST AND QUALITY MEASURES

Measurement of cost and quality seems inherently valuable, but many organizations – and especially many university IT organizations – have little or no idea what their services cost, what the customers perceive the quality to be, and in some cases organizations do not even have a systematic understanding of what their own services are. These problems once plagued the IT organization at Indiana University to a greater or lesser extent, but began changing out of both a leadership commitment to quality and changes in the budgetary organization of the University.

The leadership of any organization will claim, in at least some abstract sense, a desire for quality. Turning such a desire into tangible and effective actions, however, is a critical challenge. In fact, one can hear customer satisfaction surveys dismissed with the remark “we know what's right more reliably than customers do.” While this is possible in the short run when a technology organization leads in a dramatic new technological direction, it cannot long remain the case if the technology organization is providing what are in fact excellent services and communicating effectively with its customers. The desire for both quality in services and effective, fact-based communication with users, then, lead to the first professionally conducted survey of satisfaction among users of the IT organization's services.
There was another impetus for the creation of the User Satisfaction Survey. Indiana University adopted responsibility center management (RCM) on the Indianapolis campus in 1989 and on the other campuses beginning in 1990-1991 (Whalen 1991). In this scheme, the several IT organizations were classified as responsibility centers. RCM was implemented in slightly different forms on the IUB and IUPUI campuses, but in both cases funding for the central IT organization was taken out as a "tax" from other responsibility centers with no discretion available on the part of the unit being taxed. While the central IT organization at IU views its constituents as customers – and valued customers at that – the budgetary process creates a system where the users of the central IT organization are in some sense, at least, captive users of our services. As one might easily have expected, some responsibility centers claimed that the centrally provided services were inferior, and that given the ability to run independent computing organizations they could deliver better services than those offered by the central organization. The satisfaction survey was seen as one way in which UCS could responsibly demonstrate to the university as a whole that it was, in fact, delivering quality services and credibly claim that it was making good use of the funding it received from the University.

From the very first deployment in 1991, the survey was designed and managed in a fashion that assured its reliability, credibility, and integrity. The survey was, and remains to this day, administered by an independent survey organization within the University. The surveys for the Bloomington campus have been handled since 1991 by the Center for Survey Research, and the Office of Information Management and Institutional Research at IUPUI was recruited to take responsibility for the Indianapolis campus when the survey was extended there in 1997. The survey is sent to a stratified random sample of faculty, staff, graduate students, and undergraduate students. While the sample size has varied somewhat over the years, it has always been sufficient to assure a good understanding of the opinions of the users of the customers of the central IT organization. The random selection of recipients was done by the survey agency, as were the final design of the survey, mailing, and the tallying of results. This assured anonymity and credibility of the results. The survey was structured with standard Likert Scale results from "1" ("Not at All Satisfied") to "5" ("Very Satisfied"). In addition, there is an opportunity for open-ended comments at the end of the survey. We have assured consistency in the general structure of the survey structure and key questions over the years, thus assuring that we can make long-term comparisons and judgments about our services. We use three forms of summary statistic: the percentage of people responding to a particular question indicating that they make use of a particular question; the average results for any question, and the percentage of respondents responding with a "3," "4," or "5" (which we take to be the percentage of respondents basically satisfied with a particular service). Average scores are always reported with 95% confidence intervals and the number of people responding to a particular question to establish the veracity of our results. The free text comment responses are also read carefully to ensure that the IT organization draws the proper conclusions from the survey results. In fact, these written comments are the best "leading indicators" of future demand for new services.

Details of the survey are available online at http://www.indiana.edu/~uitssur/survey/index.html, but a few key results of the now ten years' worth of survey data will exemplify important trends and demonstrate the importance of the survey in the ongoing effort to achieve and maintain excellent quality. Figure 1 provides the satisfaction percentage for overall computing services provided by the central IT organization to the Bloomington campus. Clearly overall satisfaction with our services is very high.
Our success in maintaining overall high satisfaction is the result of many factors, including careful attention whenever a specific service seems to be perceived as inadequate by its customers. Over the years survey results have had important roles in many service decisions. Chronic poor satisfaction with the University’s dial-in modem pools was used to justify expansion and improvement. Customer reaction to pilot deployments of various e-mail services played an important role in decisions not to deploy them widely, even though in their time each was very much in vogue. User response as measured by the survey has also helped us to verify our assessment about improvements in services such as student computer laboratories and online help services. Our standards have become so high that any service with an average score below 4 (out of 5), or a satisfaction percentage less than 90 percent, is considered in need of improvement. Each year UITS prepares an internal quality assessment and improvement plan for the coming year. The importance of the survey within the organization is such that it has become the key indicator of quality in these internal reports, and a dip in user-perceived satisfaction is viewed as a call to arms by both staff and managers without the prodding of senior management.

That the survey is used internally by the central IT organization is important, but so is the thorough, rapid, and consistent dissemination of the survey results. Prior to the widespread adoption of the Web, survey results were published in the IT organization’s printed newsletters, online information systems, and e-mail newsletters. We now publish the results on the Web. The survey is sent out in February, with acceptance of responses ending typically at the end of April. Results are tabulated by the survey organizations and then published on the Web during the summer. In fact, every survey, and every comment ever written on one of the survey forms, is available on the Web. In addition to disseminating the results of the survey, we assiduously publicize the changes we make in our services as a result of the user survey.

A tremendous amount of credibility in the survey results from the way the survey is managed and the way the results are publicized. During 1991 return rates ranged from 23 percent for undergraduates to 50 percent for faculty on the IUB campus. The response rate for the most recent survey conducted at IUB ranged from 41 percent for undergraduates to 71 percent for staff. This is a phenomenal rate of return for this type of survey, and it results in part from the use of incentives (typically a free CD of site-licensed software that would otherwise carry a media cost $5 to $10) but more importantly because our users recognize the importance of the survey in helping the central IT organization assure and improve quality. At IUPUI, where the user survey was instituted in 1997, response rates started out as low as 26 percent (for graduate students) and ranged from 36 percent (for undergraduates) to 48 percent (for staff) in 2000. Clearly the survey is seen as part and parcel of improvements in quality and service of the central IT organization.

The survey has been of particular value at certain points in the history of the IT organization at IU. In 1994, the central computing organization announced a plan to phase out
use of VAX systems within three years, to the shock and horror of a large portion of the university community. IU had at one point operated the largest VAX installation at any academic institution in North America, and it had been the mainstay of faculty and student computing for a decade and a half. The team assigned to manage this project set as a goal the following: that at the end of two years, 95 percent of the respondents to the user survey would answer that the changes in the computing environment had been such an improvement for them personally that the improvement outweighed the difficulty of the conversion. The credibility of the IT organization and the survey itself was such that this goal, widely publicized, was a key element in acceptance of the proposed changes by the university community. That acceptance, of course, was one of many requisites for the success this project ultimately enjoyed (Stewart et al 1998) – and indeed the goal set at the outset of the project was met. This exemplifies the role assessment of user-perceived quality has for both the IT organization and its customers.

Although service quality is critically important, it is also important to determine the cost and value of services delivered. The methods used in Activity Based Costing for UITS services generally follow those in publications by Robert Kaplan and colleagues (Kaplan and Norton 1996, 2001; Kaplan and Cooper 1998) and by John Shank and Vijay Govindarajan (1993). For UITS:

Wages and benefits are fully allocated to the design, deployment, and operation of each service throughout its lifecycle. If individuals work on more than one service, they are asked to estimate the percentage of time they spend on each. These estimates are usually accurate within a few percent and are sufficiently accurate for ABC calculations. The costs of training are allocated to appropriate individuals and services and are registered as a cost in the year they are completed.

The hardware that delivers the service and the hardware that supports those who deliver the service are depreciated over a three-year period, and one-third of the total expense is allocated to the services they support each year. Operating systems, system management software, and applications software are taken as an expense in the year that they are purchased. Likewise software license fees and maintenance contracts for hardware and software are distributed among the costs of services they support each year.

Where appropriate, charges for telephones and voice networks are allocated to particular services. The costs of Local Area Networks are distributed among the services they support. Costs for the campus networks and for Internetworking, on the other hand, are calculated on a per-packet basis and taken no further…

In general, the direct costs for producing these services have been covered in the categories discussed above. However, there are costs that span the entire organization, and there are costs that are not included in the UITS budget but are borne by the campus and the university. The former we have designated "Organization Sustaining Activities," and in the choice of this term we follow general ABC practice. Included among these activities are the costs of the senior leadership of UITS -- the Vice President and CIO, Associate Vice Presidents, and Deans -- plus the Human Resources Office and the Business Office. The costs for these offices and their internal services are distributed proportionally among the several external services. If a service, such as E-mail, receives 10 percent of the total budget then it is allocated 10 percent of the total costs for the Organization Sustaining Activities …

The … ABC figures do not include the cost of facilities and utilities. IU does not bill UITS for the buildings it occupies, the maintenance of these buildings and their grounds, and the cost of electricity, heat, and chilled water. [If the ABC figures available on the UITS Website (http://www.indiana.edu/~uits/business/scindex.html)] are compared with the private sector (few of which offer public benchmarks), then 13 percent must be added
to the UITS costs. This percentage is not arbitrary but has been derived from an IT industry average for facilities and utility costs (Peebles and Antolovic 1999: 21-23).

Perhaps the most dramatic use of cost and quality measures came in 1999, when the decision was taken to reengineer the mail systems once again. When the DEC VAX cluster was retired, Pine, an excellent character-based mail system written by the University of Washington, was selected as the default mail system for students in Bloomington (and was also adopted in Indianapolis shortly thereafter). By 1998 it was clear that satisfaction with Pine was decreasing rapidly because of its inelegant and complicated method of handling attachments. The first choice for a replacement was Microsoft Outlook/Exchange. This system was covered under the university Enterprise Licensing Agreement, so the application would come without additional cost. However, when the support costs of Outlook/Exchange was compared to that of Pine, it was clear that the support centers in Indianapolis and Bloomington received ten times the number of calls per year about the former than for the latter (Peebles 2000). In effect, the support costs would exceed the costs of the hardware necessary to support Outlook/Exchange for some 100,000 additional users. The decision was taken to find a Web mail client that would not generate more than 25 calls per hundred users per year but that would handle attachments with grace and satisfy our customers. Such a system, IU Webmail, was fully deployed in January 2001.

GENERAL SUPPORT SERVICES

Information technology (IT) has permeated our lives and culture at work, at home, and even at play. A decade or so ago, one would have been fortunate to have a computer available on the desktop at the workplace. Few were fortunate to have such devices to assist with educational pursuits, and certainly fewer had such devices in the home. IU has experienced tremendous growth in the number of students bringing computers to the university to assist with their studies. In 2000, 85.2 percent of students had personal computing workstations at their residences; this represents an increase of 42 percent in just 9 years.

Courses are now available online, communication between faculty member and student is often via e-mail or electronic chats, and homework is submitted and often graded electronically. Administrative functions, such as applying for admission to the university, registering for classes, administering human resource tasks, and even paying for parking tickets, are performed online. To add more complexity to this crisis, not only have the number of faculty, staff, and students who own/use a computing workstation increased, the number of devices per individual has increased! IT support now includes more than the individual’s workstation on the desktop at the place of work. Many of these individuals also carry a palm device, have access to a laptop machine, and have one or more computers at home, not to mention (if you are a student of higher education) the portable MP3 player. Since we are not yet at the "Information Appliance" stage, IT support demands have risen exponentially while most support organizations experience either a modest or zero funding increase.

Support of the ever increasing number of users of IT services is absolutely critical in an age that depends more and more on these services. This IT "support crisis" (McClure, Smith, and Sitko 1997) is really a crisis of knowledge – knowledge management and the key components of knowledge transfer.

In the information technology-dependent world, support is arguably the most important component to the success of information technology use. Institutions today spend tens of millions of dollars on the computers, servers, software, and network equipment that form the IT fabric of their enterprise. What can be lost in these staggering numbers is that the benefit of these investments is in the hands of those who make use of it. And if they cannot make productive use of all those dollars of investment, then it truly is money that goes down the drain. Successful employers of technology have come to realize that it is not the technology that needs the support;
it is the users of technology who must be supported. This focus on the user rather than the technology does not just happen; it is a strategy that must be well thought through, well planned, and well executed (Voss, 2001).

General purpose end-user IT support at IU consists of a set of services provided by the central IT organization (UITS). UITS has addressed the support crisis by implementing procedures and management practices which result in high-quality support through proactively addressing IT problems and reducing the need for personal contact, by utilizing tools and resources to decrease the time required for each contact, and by providing tools that will provide the end-user with self-service support.

IT support at IU is available to any of the university’s approximately 115,000 faculty, staff, and students. Support for specific faculty and staff workstations and applications on these machines is delivered by staff in the individual schools and departments and will be addressed below. The UITS organizations delivering support to the end-user are:

- Support Center, consisting of a Call Center, Walk-in Center, and Online Support
- The Knowledge Base, an online repository of nearly 7,000 searchable answers to IT questions
- Student Technology Center Consulting, providing assistance to students using the 1200+ workstations available for student use on campus
- Residential IT Support, providing assistance to the 11,000 students living in university housing
- Education Program, providing IT education via short non-credit courses taught in the classroom and online.

The Support Center provides general purpose IT support to approximately 400,000 contacts per year (at a cost of ca. $7.00 per contact). The subject matter of these contacts varies greatly, and may range from students requiring help connecting to the central modem pool from their home or apartment to an administrative user of our mission critical systems requiring assistance with authentication. Unlimited support is provided free of charge to IU faculty, staff, and students via the Call Center, Walk-In Center, or online. Calls placed to the Support Center are routed via an ACD (Automated Call Distribution) system to the proper support queue. The current queues consist of: computers/applications using Windows operating systems, computers/applications using Macintosh operating systems, computers/applications using Unix operating systems, users of IU administrative systems and networks, and general IT questions. Walk-in Support is delivered from two central locations assisting users with issues requiring photo ID authentication, workstation configuration/troubleshooting, or by answering general support questions of persons who are in the area. This group also focuses on account distribution, and provides accounts and training for the 12,000+ new students attending Orientation each summer. Online Support is delivered both via e-mail and by self-service from the international award-winning Knowledge Base, which is discussed extensively later in this paper.

This is support of the masses. In order to meet the demands on a stable or slightly increasing budget at the same time demand for support was increasing exponentially, efforts were made to reduce the need for direct, personal contact of these service units. A major emphasis was placed on providing proactive support instead of reactive support: work, activities, communication, and tools can be created and deployed in advance which eliminate or reduce the need for personal contact with the support units. An example of such work includes the creation of a CD given to students as they move into the residence centers. The CD contains a utility that automates the network configuration for connection to the campus network. Additionally, an effort has been made to reduce the time required to address the issues of each support contact with the goal of increasing the quality of the answers provided, which in turn eliminates the need
for repeated contacts. Providing an answer in the shortest amount of time allows more contacts to be made in any given time interval. To increase the technical and customer service knowledge of the staff, development and training plans were devised for all staff. This initial and continuing training in turn serves the customer by solving as many problems as possible without referral and by eliminating the need for additional contact because the problem was solved.

The quality of the Support Center services are measured by the plan, check, do, act methodology (Deming 1986, Box 1997). Once per year, an extensive survey of all UITS services is conducted, as described in another section of this paper. This survey provides global feedback consistent from year to year. This is valuable data; however, it is necessary to measure support processes on a daily basis to find a possible problem before the process is "out of control," in the sense meant in statistical process control. In manufacturing, this is accomplished by measuring groups of widgets and comparing to an acceptable metric, given a specific tolerance. However, for IT support delivered from person-to-person, en masse, it is much harder to measure and discern whether the process is about to go "out of control." The goal was to have a simple measure every day of the services provided by the previous day’s work of each Support Center team. This metric had to be something non-intrusive for the end-user, yet informative and indicative of the support provided, as well as serving as an indicator of a process beginning to go out of control. Given a great deal of thought, this process was simplified to three key metrics that, if all performed well, would lead to extremely satisfied support customers. Here are the questions that deliver the $1M answers daily:

1. Did the customer receive a solution
2. in a timely manner
3. and delivered with courtesy and respect?

To measure the quality of the support contacts, each day 45 customers who contacted the Support Center the previous day are randomly selected and sent e-mail asking the above three questions, and given a space for general comments. Of course, customers will only be satisfied IF they receive a solution, but ONLY IF this answer is delivered in a timely manner (where timely is defined by them). If these two issues are addressed appropriately, then and only then will customers be satisfied, and they will be truly satisfied only if they feel they have been treated with respect in the process. Measuring these three areas of service every day is a critical element in the quality of service and in the management of scarce resources. Every day, the manager of the unit reads each of the survey responses, and every "no" receives both an action to allow for correction of the service and a chance to address the problem a second time. These metrics are used only as indicators, not as job performance measures. For instance, these responses may indicate the need for consultant training or tools. The metrics may indicate the given resources are not meeting customer expectations for response time, and require resource adjustments. The metrics may indicate the need to provide assistance, training, or management of the work attitude. A surprising result of the survey is that it often provides good positive, direct, feedback to the support consultants, as many surveys are returned with compliments for the excellent work provided in the interaction. Rarely do support personnel receive positive reinforcement of their work; they are typically contacted only with problems. It’s nice for them to hear reinforcement for their work. A recent survey included the following comment:

Date: Mon, 15 Jan 2001 11:15:49 -0500 (EST)
From: kdyn <kdyn@indiana.edu>
To: <scpc@indiana.edu>
Subject: Re: Dell Optiplex GX1..MS Natural Keyboard (#269.1445)

THANKS, Jim. Please forward my message on to your boss - this is the BEST
service I've ever gotten on ANY computer-related problem anywhere. I'm glad my technology fee is paying your salary. THANKS.

An analysis of the survey responses for the first ten months of the year 2000 indicates the aggregate average user satisfaction (Table 1):

<table>
<thead>
<tr>
<th></th>
<th>Total Responses</th>
<th>% Satisfied Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>Call Center</td>
<td>1067</td>
<td>92.7%</td>
</tr>
<tr>
<td>Walk-In Center</td>
<td>148</td>
<td>94.6%</td>
</tr>
<tr>
<td>via E-mail</td>
<td>195</td>
<td>88.2%</td>
</tr>
</tbody>
</table>

Table 1. Aggregate average user satisfaction

The key to such measurement is to find the three or so simple indicators of service satisfaction (this is also the hard part), and put them in simple metrics to give consistent indictors of the service provided. Note in the above that e-mail always produces a lower measure of satisfaction on both the daily and yearly quality surveys. E-mail takes several exchanges between the customer and Support Center just to define the problem, which is much more costly in terms of time and dollars. It is the cost in time that leads to a lower Satisfaction Score.

Many users prefer to ask a person the answer to their IT question, either face-to-face or via the telephone. Although this is a valuable function that has its place in today's support model, the resources available for such support typically do not scale to the demand. We need other tools – automated self-service tools – that leverage today's technology to provide the knowledge the users need to address their own IT-related support needs.

The Indiana University Knowledge Base (KB) is a collection of such knowledge, easily accessed at http://kb.indiana.edu/ for answers to IT questions. This collection of knowledge is made available electronically for automated online retrieval by those searching the information, 24 hours per day, seven days a week, 365 days a year. The KB is a collection of problems and their associated solutions, stored in a database, and retrieved upon demand by anyone who can identify a problem (even a symptom of a problem) to the system and interpret the resolution provided by that system associated with that problem, or a set of problems like it. The KB is, essentially, an IT expert system. The Web-based interface allows the user to enter a question (keywords, and even natural language questions), and then it searches an information database for possible answers to the question. Those answers are offered to the users, who can then resolve their own problems.

The KB is a system with three physical components:

1. It is a repository of problems and their resolutions (currently holding nearly 7,000 entries)
2. It is a search engine to sort through that repository (currently handling over 50,000 queries each week)
3. It is a user interface that allows a user to engage the search engine to manage the data (currently used by hundreds of thousands of users worldwide). By comparison, our other means of support (telephone, e-mail, and walk-in) are only capable of answering about 7,000 questions each month!

The Knowledge Base receives about 6.5M hits per year (at a cost of ca. $0.11 per hit). It came into existence as early as 1988, when it was recognized that IT staff turnover was
significant, especially among the many highly qualified student hourly employees. Often, knowledge would walk away with a staff member when he or she left the organization. The benefit of the training and knowledge of the departing staff person was lost, and given to the new company or organization. A radical idea of collecting this information electronically and sharing it with other IT staff resulted in what is now recognized by Yahoo! as "The Best Online Support" (Microsoft is second) tool (Yahoo!, October 1997). First, the KB was created as a Gopher application to collect, store, and share computing information between Support Center staff. This tool helped retain information and knowledge when key staff left the organization. The KB also helped avoid the expense of solving the same problem over and over, by providing storage of the answer available for retrieval by all Support Center staff. A brilliant idea was born with the advent of the Web: make the information available to users, so they could attempt to solve problems themselves first, before contacting staff resources. This information is available when the Support Center is closed, and it is available to users wherever they happen to be in the world! The KB is a proprietary information system that was created before any such applications were available on the market. It has developed constantly over the past 12 years to best serve the faculty, staff, and students of Indiana University. The KB now has nearly 7,000 answers to our users' IT questions, containing campus-specific information when appropriate. While focusing on information for IU affiliates, it is available and heavily used by people all over the world seeking answers to support questions. The KB has extensive quality control measures in place. A KB document can originate with anyone, but typically begins with a staff member. This information may be written in techie-talk, the point being to capture the knowledge. KB staff members write the document in layman's terms, making it understandable to the general population, and bringing it into conformity with KB style standards. At some point, an assigned technical expert reviews the document for accuracy before it becomes accessible in the KB for general access. This may sound time-consuming, but with proper workflow management tools the process actually moves quite quickly. The mantra of this team is that incorrect information is worse than no information. Each KB document has an assigned owner, and some an assigned lifetime. The owner is responsible for the maintaining the accuracy of the document. The lifetime acts as a timer that automatically informs the KB team when the document is due for review. The team's goal is that all documents be reviewed at least once per year. It is recognized that having even a single wrong answer produced by the KB can quickly destroy users' trust in such a system. The KB will likely have over 7M hits this year. Statistics show more than 25 percent of the IU population use the KB a few times each week, suggesting a fair number of users use the KB "regularly", and that it is a part of the users' own support solution.

The Knowledge Base is a knowledge management tool used to help the institution leverage its scarce IT support knowledge resources, and it ultimately allows users to support their own use of information technology (Voss, 2001). The ultimate goal of the KB is to provide the answers to questions that will be repetitively asked, saving our human resources for those questions or problems requiring human logic, problem solving, and intervention. The KB utilizes technology to deliver answers of a repetitive nature. Machines do not get tired of providing the same answer hundreds of times per day. Thus, it becomes possible to utilize scarce human resources for what humans do best: problem solving and intervention for new issues.

The heart of the management of the support center is a "work flow system" (others may refer to "trouble ticket systems" or "customer relationship systems", but UITS carries the use of this system beyond this definition) that provides a single source to manage staff workload, communication, and information. This system ensures wise use of scarce staff resources, avoiding re-discovery of a solution to a problem that has already been solved, avoiding duplicated (or worse, triplicated) efforts, assigning the proper task to the proper person, managing and tracking the escalations, and managing and tracking the KB documents. This system is an entire paper in itself. This system provides standard metric information, and allows for ad-hoc reporting pertinent to management questions. This system began as a Support Center tool, and has since
grown into a management tool for the entire central IT organization, and even further, as a reporting and management tool for customer use. IU began using a trouble ticket system about the same time as the birth of the KB. Early, it was only a problem management system, tracking incidents from initial report to closure. This system simply was not sufficient for the comprehensive needs of the support organization. In 1997, the problem management system was converted to an all-inclusive Web-based electronic "workbench", easily customized by and for each consultant. This electronic workbench reduces staff training time by centralizing each consultant's workload, training, and tools into one central system. This system incorporates every part of the work, and facilitates the KB creation process described above. It is now time to create such a system to serve the entire university system, allowing users to create and track problems themselves. Such systems are now available on the market, and IU is in the final phase of evaluating systems to replace our homegrown productivity tool.

UITS maintains more than 1200 workstations, located in more than 40 Student Technology Centers distributed around the Bloomington campus. (Similar facilities are available at IUPUI, but they are, for the most part, run by the several schools and departments). Consultants are available in 30 of these centers for some part of each day, and at least one center has a consultant available 24 hours per day. Approximately 200 students are employed to deliver support to the students in the centers. Student consultants are trained and tested on the set of skills necessary to provide valuable support to the 50 percent of the student body that uses the services of these consultants each year. Shifting the training content from purely technical training to a program focusing on service orientation and resources available for technical support (such as the Knowledge Base) has resulted in approximately 89 percent of students rating these services as "Satisfactory" or better. This shift of focus has increased the level of satisfaction over the last decade from less than 75 percent to almost 90 percent (Peebles et al, 1998: 48).

Less than one year ago, UITS assumed responsibility for providing IT supports to the 11,000+ students living in the residence centers on the Bloomington campus. This support includes in-room IT assistance provided by 40 part-time student employees, and 400 workstations located in the Residential Technology Centers distributed among the residence centers. Training, tools, and resources have been implemented, and metrics and quality control techniques are being applied to these services. However, the services are too new to conclude satisfaction levels.

The better educated/trained that users are, the better prepared they are to support themselves. In the past, education was essentially the user's responsibility, and while the IT organization might provide it, it was not part of its base function and hence was placed on a cost recovery basis. This was a flaw in many central IT structures during the IT Support Crisis, and in fact probably contributed greatly to the crisis in the first place! Fundamentally, the issue is that of knowledge transfer, from the IT organization to the user. And the IT organization needs to understand that its role in knowledge management includes ensuring that the users have the skills necessary to make use of the IT tools on their desktops.

For end-users at IU, this education is free (that is, highly subsidized) through programs that equip them with the basic technology-use skills they need to use IT effectively. Today the challenge of the IT organization to provide traditional, in-class instruction is most likely beyond the resources and capabilities of even the most dedicated and well-financed IT organization. However, the market has responded with a number of tools, most especially computer-based training (CBT). The challenge of the user is to carve time to attend the courses and learn the information. IU has addressed both of these challenges by providing traditional classroom training for those who need to learn a comprehensive application or skill. Snippets of CBT courses have been incorporated into topics of the Knowledge Base for those who only have a few minutes to learn a specific topic. For instance, a user might register to take a 3-hour course on advanced uses of spreadsheets. However, the user searching the KB to learn about Unix resources may elect to follow a link that will deliver a 10-minute CBT training on the syntax of a particular Unix command.
The number of "students" who are satisfied has been consistently high over the last 5 years, with 95 percent of the faculty, staff, and students rating this program as "Satisfactory" or better in 2000.

The delivery of high quality IT support consists of not only the teams mentioned here, but requires attention from each area of the IT organization. Careful implementation and change management processes must be in place. Communication between the organizations and the customer must be effective and concise. All organizations must have user satisfaction in the forefront of all plans and products.

**SPECIALIZED SUPPORT SERVICES**

The Pareto 80-20 rule plays itself out in many ways in a University environment. The largest part of the university community employs a fairly standard suite of computing tools: e.g., word-processing, e-mail, spreadsheets, and web browsers. However, the intellectual accomplishments that move human knowledge forward and distinguish IU from many of its peers are created by people with more esoteric computing requirements. IU recognized, and began addressing in a systematic way, specialized support needs in 1991, when it first created the Center for Statistical and Mathematical Computing. There was a perception that statistical and mathematical computing was a critical tool, used across many – but far less than all – departments, and that this software required increased support and expert support. Statistical and mathematical consulting had previously been the responsibility of one professional staff member, an expert in statistics and statistical consulting – but burdened by the task of updating the roughly 35 different statistical and mathematical software packages installed on central computing systems. There was consensus that more support was needed, but also support of a particular type – from consultants expert in using advanced computing software but also well-versed in statistics or mathematics. Thus to the statistical computing expert (himself the holder of an Ed.D.) was added a manager, a mathematical computing consultant, and two graduate assistants. The full-time staff members of the Stat/Math Center were initially, and have typically remained, holders of a terminal degree.

The Stat/Math Center has been a tremendous success, for the following reasons. First, it was recognized that although some needs were highly specialized, many needs in statistical computing and mathematical computing were consistent across many departments. Thus a software support model was initiated in which software was categorized as of general utility (within the area of statistical and mathematical computing), of specialized but critical value to more than one department, or of extremely specialized utility within a single department. For software of general utility, the Stat/Math Center committed to providing expert consulting help, capable of solving straightforward problems over the phone, and committed to solving, in one way or another, any problem – even if this required working with the software vendor to get errors in the software corrected. For software of specialized but critical value to more than one department some consulting was provided, but with no promise to be able to answer a question immediately. For software of utility only within a single department the Stat/Math Center committed to install the software and assure its correct functioning but made no provision for consulting support. In this way the resources of the Stat/Math Center were focused on activities that were both strategically important and appropriate for the central IT organization.

Another critical factor in the success of the Stat/Math Center was its strategic positioning within a consortium that addressed statistics in research and education generally. The central IT organization partnered with the campus and particularly the Department of Mathematics to create the Interdisciplinary Consortium for Statistical Applications (ICSA). ICSA provides statistical consulting services offered by faculty in Mathematics and special courses. Professor George Box's admonition that statisticians work in depth and on an ongoing basis as partners with
researchers has been standard operating policy for ICSA since its inception – with the slight variation that our structure typically involves a team of three: the researcher, a mathematical statistician, and a statistical computing expert. This approach has been found to be extremely effective, and over the years both new statistical tests and new computer implementations have been developed as a result of this collaborative approach.

The Stat/Math Center has become a model for the delivery of specialized consulting services, including the Library Electronic Text Services (LETRS), the Unix Workstation Support Group (UWSG), and the Advanced Visualization Laboratory (AVL). The commonality among these groups is twofold: that they provide strategic, specialized services that are critically important to the intellectual and artistic accomplishments of the university, and they all provide services employed by a segment of the University community that spans multiple academic units. LETRS is operated in partnership with the University Libraries, and provides services and consulting in the electronic delivery of humanities texts. Within the IU Libraries, LETRS works particularly closely with the Victorian Women Writers Project, well known as a premier source for electronic delivery of texts by woman writers of the Victorian era. The Unix Workstation Support Group provides site licenses, consulting, and training in support of people that employ some variant of Unix as their desktop operating system – including researchers in computationally intensive areas of the sciences and students running Linux in their dorm room. The Advanced Visualization Laboratory operates immersive 3D visualization facilities (CAVETM and ImmersadeskTM) and provides consulting services in support of use of advanced 3D visualization techniques. In addition, the AVL has developed, and distributes, software for 3D visualization. This development work has taken place in collaboration with the Departments of Computer Science and Chemistry at IUPUI and IUB, as well as the IU School of Medicine.

In all of these service units, quality is assured by provision of staff that are experts in both the computing technology and the subject matter to which the computing technology is applied. Of these groups, the managers and many of the staff have traditionally been holders of a terminal degree. Furthermore, these specialized support units regard themselves as partners with the faculty, staff, and graduate students in their research and education endeavors. Staff in these areas commonly publishes formal academic papers. In these specialized services, it is the ability and desire of the computing center to be partners as well as supporters that creates excellent support. In each and all of these specialized support services the proportion of satisfied customers is above 90 percent.

**DISTRIBUTED SUPPORT SERVICES**

In today's information technology environments, several support models concerning distributed support services have emerged (McClure, Smith, & Lockard 1999). The classic set includes:

- **Centralized**: a model in which the preponderance of support is based in resources in a centrally located organization and service is delivered directly to end users;
- **Decentralized**: a model in which formerly centralized support resources are divided into parts and then assigned to sub-units of the enterprise to deliver support to end users;
- **Haphazard**: a model that results if no one in the enterprise exercises leadership, or fulfills user expectations to their satisfaction; and
- **Distributed**: a model in which both centralized and sub-unit-based resources blend in some fashion to meet the support needs of the enterprise.
The latter model seems to have been the most widely employed (in its multitude of forms) and most successful in delivering support needed by users at larger institutions and enterprises. Sometimes this model is the result of years of planned calculation as was the case at IUB. Sometimes it is a rapid response to the IT Support Crisis, as was the case at University of California - Davis. And in other cases, the model evolves in almost feral form, as a response of the environment to the conditions that exist within it, as was the case at IUPUI.

However, the model that we see, regardless of how it comes about, is one in which support stratifies into three basic components, each with its own role to play (Voss, Alspaugh, Workman, & Schau, 1998):

- Support provided by the central IT organization
- Support provided by the users of IT themselves.
- Support provided by staff who reside in organized segments of the enterprise – we'll use "departments" as the designation for these segments

How successful various institutions are in making this model work depends on how well this stratification is leveraged by the central IT organization. A large component of the central IT organization's role is to enable the success of the other two (Voss, 1995). The previous two sections of this paper have focused on the central IT organization's role in providing direct end-user support (general and specialized), as well as the use of the Knowledge Base tool to assist users in supporting themselves. Let us examine now the role of the central IT organization in fostering and providing quality support services to the distributed local support providers in departments.

Distributed support services started out at Indiana University Bloomington as part of a deliberate effort to establish local support in departments beginning in the late 1980's. Through a program called "Distributed Support Assistants" a support resource was provided to a department as part of a two-year commitment. In the first year, these assistants – or DSAs as they were called – were hired and funded by University Information Technology Services (UITS – then called UCS). They were placed into the local departments and assigned "supervisors" within the department's administrative structure, though they were led from technology and service-orientation standpoints by a coordinator within the UITS organization. In the second year, the funding became shared (50-50) between the department and UITS, and at the end of the contract UITS funding would cease, and the position would continue only if the department elected to fully-fund the service (versus simply dropping from the program). In all cases (approximately 26 DSA agreements were signed during the 5 years of existence of the program), the department(s) elected to continue funding the position(s) and in several cases augmented the investment with additional staff positions.

This "seeding" had several advantages. First, it enabled UITS to help department administration and faculty and staff themselves, to see the value of local IT support over a period of time, rather than the issue being forced upon them by central dictate. This "try and buy" approach helped with local acceptance of the investment, rather than engendering a sense of "un-funded mandate." Second, it allowed the support structures to develop in departments under the tutelage of UITS, thus ensuring consistency of support quality and methodology across the campus. Third, the "bipartisan" partnering efforts created a sense of common purpose between distributed and central support providers, rather than an unhealthy, competitive environment.

Even unforeseen consequences that started as dark clouds became silver linings. As the success of local support advanced, this created a separate and new job market for support talent. Historically, UITS was the "only game in town." Now, with dozens of jobs appearing on campus, competition for skilled staff increased. Wages increased and talent became scarce. Departmental resources usually could out-bid UITS for talent – hence UITS took a new (and lower!) place in the employment food chain. But as UITS-trained talent went into departments, both the quality
and coordination of support increased. Prodigal sons and daughters well trained in service and
technology went into departments, but stayed in close contact with their friends and former
colleagues in UITS. And like prodigal sons and daughters are inclined to do, eventually they
returned "home" to UITS – coming back with a far better understanding of user needs and
sensitivity to local issues and concerns. What developed over a period of 5-6 years was a thriving
culture of support, where positions existed both centrally and locally, and career paths developed
in a series of "zigzag" opportunities through both environments.

But even the success of the DSA program did not meet all the latent demand for local
support. Many departments, on their own, established local support positions. Mostly these were
simply designations of existing staff with technical proclivities (e.g., the file clerk with not much
filing to do but who was good with computers, became the defacto DSA). Other times they were
newly established technical support positions. But quickly what became clear was that these
positions, isolated and not part of the DSA program, did not have the best trained people in them.
But this, too, became an opportunity for UITS.

Again answering customer-communicated needs, UITS launched a program to train and
inform these "feral" local support staff. The Technical Information for Excellent Support – or
TIES – program was launched. TIES was a series of 10-12 weekly sessions through a semester,
each focused on a given topic of technology or support. These short "how to" sessions were
focused on imparting skills, and increasing the sense of being "in-touch" with the central support
staff and the rest of the distributed support providers. Often, TIES sessions might even be taught
by a DSA, increasing the crossover effect. The success of TIES was really a reaffirmation of the
understanding that education is a key – well-trained staff does a better job of supporting their
constituencies.

As the years progressed, and these "wild" support positions merged with the local support
environment, and the resource pool increased as the market demand for IT skills took hold, TIES
evolved into more focused and technical training programs. Now, detailed education was
required. And more than that, so was proof that knowledge was imparted and skill obtained (a
concern voiced by departmental managers of TIES participants). So a second piece was needed –
certification. And with this was born ED/Cert training programs in the mid-1990's that carry on
even today.

The distributed support environment was growing nicely. We had seeded and feral-but-
friendly local support, and we had training programs, evolving toward certification efforts. But
as the DSA efforts of seeding were ending, came the understanding that we had to find ways to
remain closely in-touch with the developing and thriving local support community, lest all our
hard work at building relationships be lost! The DSA and TIES-ED/Cert efforts had been a
partnership between departments and the central IT support organization. What we needed to do
was maintain that partnership, in spirit and practice. The answer was PICS – Partners in
Computing Support.

PICS started out as a philosophy with a desire to have something material beyond a
traditional user group. In its first days, UITS leveraged a small amount of central funding to
provide a set of tools (centrally served CDs of support information) that departments could not
afford to buy on their own. These extensive data resources were of great value to local support
providers (LSPs), and since they were provided free of charge, the value of the central IT support
organization was increased in the eyes of the local support community. PICS also provided
forums – monthly roundtables to discuss breaking technology news, or info-sharing sessions to
discuss launching of new services by UITS on campus. Through these forums, LSPs became the
first to hear of new services – and were given a chance to react and provide input into their
deployment.

As the years passed and separate programs came and went, what has been left is a central
support organization designed around the existence of a local, distributed support environment.
LSPs are both customers and partners in delivery of support. Quality and value of service are key elements in how the relationship between LSPs and UITS are defined.

As customers, LSPs are given special care. When an LSP calls the Support Center, we can identify them as such and realize they are trained professionals. Dispensing with the usual regime of problem identification – as this has most usually already been done by the LSP – we can go more directly to resolution. Often this means a direct connection between the LSP and second-level support staff. As customers, LSPs have special services at their disposal, including a Departmental Support Lab filled with application area specialists designed to give them in-depth expertise in technology and a place to examine it in detail. A LAN Lab exists to serve the needs of LSPs with local area network services deployed (which most have). And of course, ED/Cert continues to exist and flourish – and at no cost to LSP participants, knowing as we do the value of training in ensuring the success of support!

As partners, we communicate with LSPs and actively seek their input. Perhaps the most important aspect of the distributed support environment at Indiana University is that these departmentally-based staff are accepted as an extension of our own support organization. At Indiana, with our focus on quality of service, we realize that technology must be driven by its value to the users – not simply in the act of deploying new technologies by the central IT organization. We know, too, that LSPs are closer to the users than we at UITS are – that they work in the same offices and face faculty and staff each day. And we know, as a result, that they understand the environment at a level we, centrally, do not. Hence, the culture of technology at UITS is infused with an understanding of the value of the LSP community’s contribution to the success of technology. When new services are rolled out, we ask the LSPs for their guidance, whether it be in reaction to leads we take, or in seeking their advice in forming directions (taking the lead from them). No service is launched that has not been inspected and accepted by the LSP community. To do otherwise violates our partnership. And all know that the partnership is what makes IU so successful in its deployment and use of information technology.

For the UITS organization, the ramifications of a distributed support model can be seen in its structure. Just as there are teams of professionals in UITS focused on general support, and specialized support services, there are teams focused on LSP services. We realized that LSPs have two distinct types of needs. Given their "in the trenches" focus, they need someone to pay attention to what is coming down the pipe, and they need someone to be there to back them up with existing technology. In UITS, LSP support is divided into two focus groups. The first is an assessment and advising function – one that looks ahead and supplies the LSP community with reconnaissance of newer technologies. The second is a team that takes care of their current needs, providing detailed consulting and support in technologies deployed on campus.

Departmental Computing Advising and Support Services (DCAS) is the home of the aforementioned Departmental Support Lab (DSL). Here, application area experts spend their days doing the research into new desktop and groupware technologies, and helping LSPs understand how changes in these areas will impact their environments. The DSL is a place where LSPs can go, away from the press of the frontlines of support, to work with knowledgeable colleagues and test equipment in understanding changes to the IT world in which they live. The staff at the DSL are not just R&D types – but are engineers who understand that the magic is not in the technology, but in what the technology delivers. The DSL has a host of software for LSPs to try, and the staff develop expertise in each so as to accurately advise and support its use by LSPs. Printed manuals, CD-tools, and support databases are also available at the DSL – either for independent self-study by LSPs, or for answering queries via a phone call to the staff there.

Local Support Provider Services (LSPS) provides an LSP with support after he or she has made a decision to deploy a given technology. When in the midst of a problem, LSPs can call the staff of this team and get help in addressing problems ranging from minor annoyances to crisis-level support. LSPS contains the LAN Lab – a facility that replicates the many local area
network environments deployed across the campuses of IU, and one that provides a safe "test environment" for replicating and resolving problems in local installations. LSPS also has staff experts in electronic mail clients – the most widely used application at Indiana – and in operating systems and hardware environments. As well, LSPS is home to the internal LSP for UITS – a role that means our staff walk the same road as LSPs in departments, and hence gain an understanding and sensitivity for the role. LSPS draws on technology resources across UITS – in both the general and specialized area – and acts as "general practitioner" to LSPs, sending them to the exact right "specialist" resource to help resolve their problem. Finally, LSPS most important role is to be the LSP community's advocate inside UITS.

The quality of these distributed services is measured in the annual survey. A set of questions focuses on the user community's satisfaction with the departmental support services offered by UITS. The chart below (Table 2) shows the overall satisfaction as registered by the community of LSPs over the past 4 years.

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<td>93.3%</td>
<td>90.1%</td>
<td>90.8%</td>
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Table 2. Overall satisfaction with UITS Distributed Support Services

Also asked is a question of the general user population – How satisfied are you with the computing support personnel employed by your department. The following chart (Table 3) shows results to this question over the same period.

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<td>89.1%</td>
<td>85.4%</td>
<td>85.7%</td>
<td>86.8%</td>
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Table 3. Satisfaction with LSPs in departments

In the end, the need for distributed support, and the way UITS has developed and deployed the leveraged support model, has been key to our successes in delivering quality, valued services to our user community. Some key factors (Voss, Alspaugh, Kava, & Porter, 1998) are visible in all institutions that are effectively managing the Support Crisis, and which are leveraging knowledge across all the role players effectively. These include:

- **Organizing to deliver support.** The central IT organization should organize its support organization to maximize the benefit of a leveraged support model. Units or teams should be put into place to focus on the key areas of Education, LSP Support, Central Support, and Specialized Support services.

- **Emphasizing the Local Support Providers (LSPs).** The best support is that which is closest to the user. The Knowledge Base is on their desktops; their LSP is just down the hall. In order for users to make the most use of the centrally-leveraged tools and education, they need skilled LSPs on site that are well prepared to deal with specific local support needs.

- **Emphasis on building LSP skills.** The better trained/skilled the LSPs are, the higher the quality of support they deliver to their constituents. The central IT organization benefits by ensuring that LSPs are well trained and certified in the
technologies deployed in their constituencies. Hence, encourage it – give it away and make it attractive for LSPs to take advantage of it.

- **Emphasis on building User skills.** As stated before, the better trained the Users, the better able they are to fulfill their own roles. End User education is a key – as are the many ways the central IT organization can ensure they get training, from instructor-led classes to computer-based training.

- **Providing deep target areas of Specialized Support.** When the topic is non-pedestrian, the support offered by the central IT organization to LSPs and high-end users alike must be deeper. Examples include unix system support, statistical/mathematical application support, electronic text support, research computing support, data management tool support, and others.

- **Providing Tools that enable user self-support.** For users to be able to support themselves and find the exact solutions they need in the ocean of support information available to them, the central IT organization must find a way to provide a tool for them to accomplish this. Whether it is a specially-developed tool like IU’s Knowledge Base, or whether it simply a collection of available commercial and internet support resources, the successful institution will ensure that users can, indeed, use their own technology to support their use of technology.

The Leveraged Support Model and the services deployed via it have been a great deal more beneficial to the environment at Indiana University due to the presence of good ground into which those "trees" are planted. It is not just about support – people, organization, and technology tools. It is also about the environment upon which these seeds are sown.

In order to minimize the various generations of software products employed by users, successful institutions realize that there is great benefit in acquiring all-encompassing software license agreements for the basic set of tools that users need. Such deals need not be pointed toward exclusive use of a given vendor's set of products. Rather, such programs achieve their success on the support front by eliminating the constraints (usually financial and logistical) that make it difficult for users to use the latest – and most easily supported – versions of products (Voss & Schunk, 1998).

Just as critical as keeping the software in use at current supportable levels is the need to ensure that the computer hardware is also modern, and on a program to keep it up to date on a reasonable life cycle (usually three years). When users, LSPs, and central IT organization support staff are working in an environment that features modern desktop and departmental hardware, their need to deal with the problems of failed equipment and out of date technology is minimized. Unfettered by these nuisances, they can better concentrate on obtaining the skills they need to participate successfully in the support model employed at the institution and actually focus on productive use of the technology. While many institutions might have concerns about the costs of such a life-cycle program, the hidden costs of lost productivity and failure to effectively utilize IT in their environments should be examined. Many believe that these costs completely justify a program of modernization and life-cycle funding of all forms of IT infrastructure. Those that share this belief are among the successful few that have ended the Support Crisis, and have moved forward with the seamless integration of IT into the fabric of their environments.
CONCLUSION: SUPPORT IS FUNDAMENTAL TO THE VALUE OF INFORMATION TECHNOLOGY

University Information Technology Services has evolved over the last decade to provide a broad range of IT services in support of the students, faculty, and staff who are Indiana University. In this process, every attempt has been made to shun slogans, exhortations, invocations, and images that would mark the quality improvement effort as just another management fad (Birnbaum 2000). To the extent possible, the exemplar and goal has been a responsive, customer-centered organization (Thompson 2000, Haeckel 1999, Cortada and Hargraves 1999, Bradley and Nolan 1998) that can and does adapt to the needs and requirements of a large, complex university community for IT services. Over this decade, the satisfaction of students, faculty, and staff with the IT services has remained remarkably high: more than 90 percent of the university community is satisfied with the vast majority of services in any given year.

The annual user survey identifies services that require drastic improvement and underscores the fact that all services require continuous improvement. Over the last decade such improvements have included better selection and training of Student Technology Center consultants, a vast increase in the number of dial-in modems for off-campus access to the campus network and the Internet, re-engineering of e-mail services (twice), better network access and technology support in the Halls of Residence, and better support of IT in classrooms and lecture halls. Daily surveys identify transitory problems of focus and constancy of purpose in the general support center. Focus groups, local support providers, and school technology committees highlight current problems that are missed by the various surveys and are especially useful in the prediction of future IT needs and requirements. These groups also ensure alignment of IT services with the several missions of the university – especially the role of IT in teaching and learning.

Other elements of the Balanced Scorecard, beyond those of customer satisfaction, focus the organization on the financial measures and implications of choices among hardware, software, network services, and support services. The internal perspective on process improvement and on the very real needs and requirements of internal customers works against the development of barriers between various teams and functional divisions. The very real efficacy of teamwork and shared responsibility, the value of continuing education and participation in national and international professional organizations is demonstrated daily not only within the organization but in improved customer service. The balanced scorecard and the user-perceived satisfaction measures are the key metrics in the IT organization's ongoing internal quality assessment and improvement. Over the years, critical and successful service decisions on phasing out and implementing services have been based on the user survey, cost measures, or both.

The overall organization of IT services is critical to their success in adding value to business processes, research artistic endeavors, and education. The IT organization, and the university as a whole, has been successful in delivering excellent support because it has been extremely attentive to this critical matter. Support that is routine and repetitive is automated and delivered upon user demand via a medium familiar to the users (the Web). Services that constitute university infrastructure, or critical support needs that span multiple departments, are delivered from the central IT organization. Local support mechanisms within individual departments solve unique local problems more effectively, nimbly, and cost-effectively than could the central IT organization. This approach to support – providing it in a way suitable to the end user and from a venue most appropriate within the larger structure of the organization – is critical to its efficacy and economy.

Yet these retrospective and prospective measures of customer requirements and customer satisfaction are not acceptable substitutes as measures for the value that IT might add to the lives of students, faculty, and staff who are the embodiment of Indiana University. Put bluntly, IT
services are valuable to the extent that they collapse space (increase access) and save time in teaching, learning, and research. IT can destroy value to the extent that it causes time to be wasted and when IT erects barriers and promotes exclusion from learning. As discussed earlier in this paper, a strong and responsive IT support organization and a good program of customer education can stave off some of the more destructive features of poor quality hardware, software, and network services. This support, however, is no guarantee that IT yields value. Thus there remains the question: Do computers and networks and applications and support really add value in excess of their costs to learning and teaching and research? There are three qualified answers to these questions.

First, in areas where computation is a species of "automation," where repetitive mathematical or other symbolic operations are undertaken (in the sense given it by Landauer 1995), then the computer can be used as a direct replacement for human effort and can add value directly. For example, there are computations in the physical and biological sciences used to solve problems in quantum chromodynamics and the folding of proteins that can only be undertaken with computers. Similar examples can be found in the Social Sciences, and even the Arts and Humanities. The value of IT in these cases is getting solutions that could not be gotten in any other way.

Second, under the heading of "augmentation" (again in the sense offered by Landauer 1995), where the computer cannot completely replace human effort, capacities, and judgment, but can augment them, there are the obvious benefits of finding books and articles through the mediation of the World Wide Web and effecting their delivery either electronically or through the post to home or office. In this case, there are considerable savings in time and little learning required (beyond skills with a mouse). Yet in the end it is human judgment that is applied to the results of the search. Likewise, at Indiana University, students can transact much of their business with the university via automated systems and a Web interface. This student information system allows them to register via the Web, receive their class schedule and Bursar's bill on-line, and even conduct "What-If?" scenarios with different choices of courses for their major or the applicability of the courses they have taken to a new or second academic major. A conservative estimate of the time saved by the current student information system would be 4 hours per student per year: time that would have been spent in line, waiting for an advisor's signature and at the registration center plus time that would have been spent sorting through the various publications that detail course and degree requirements. Now if those 4 hours are multiplied by 92,000 students, then the savings is ca. 350,000 hours. Even at minimum wage, the real savings in dollars is over $1.5 million per year.

Augmentation also includes things like e-mail, which seems to have become the primary means of communication on campus (along with the now pervasive cell phone), but as noted above, even e-mail requires a measure of support, especially when it comes to its initial, individual configuration of the client. When "personal productivity" tools are employed, such as word processing, spreadsheets, databases, and statistical programs, then the need for support to prevent destruction of valuable time becomes critical. Each of these programs offers too many unexpected outcomes, not the least of which are "helpful" agents in Microsoft Word that change text and add numbered paragraphs when neither are desired by the user.

Third is the role of IT in teaching and learning, which of necessity combines both automation and augmentation in unique ways, although partaking far more of the latter than the former. Considerable effort has been spent on supporting faculty in their deployment of IT in their teaching – both synchronous classroom presentations and asynchronous courses offered on the Internet. Beyond measures of participation in the creation of electronic syllabi and lecture notes, electronic library reserve materials, and e-mail communication between faculty and students, all of which fit into the broad augmentation role noted above, there is little except anecdotal evidence for the value of IT in teaching and learning. There have been recent developments in the automation of calculus homework – sophisticated and expensive systems that
generate unique homework assignments for each student and then grade the responses and suggest additional study – but these systems are used to replace "graders," which most departments of mathematics can no longer afford. Students who use these systems learn significantly more than students in classes that do not use such systems. There are similar systems available in undergraduate courses in the sciences, and they produce similar, positive results. Yet rigorous, overall assessment of the value that IT adds to teaching and learning is not available yet. Thomas Russell maintains an Internet list entitled "No Significant Difference" (at http://www.teleeducation.nb.ca) that supports in detail his conclusions (Russell 1997) that IT neither uniformly adds nor subtracts value from learning. His judgment is echoed by Michael Dertouzos in his most recent book The Unfinished Revolution: Human Centered Computers and What They Can Do for Us: "The evidence from numerous studies on whether computers improve the actual learning process is overwhelmingly . . . inconclusive" (Dertouzos 2001: 121).

Since 1997 the UITS user survey has asked faculty, students, and staff about the value of IT in their work. These questions are phrased as: "How helpful has the information technology environment been in your teaching/research/learning experience at IU?" The scale answers runs from 1="Not at All helpful" to 5="Very helpful." In the 2000 survey, the average of the faculty answers to the value of IT in teaching was the lowest of the three questions: 3.76±0.17; only 85 percent gave it a "3," "4" or "5" rating. Faculty and graduate students rated the IT environment as very helpful in their research: 4.01±0.10; 96 percent gave it a "3," "4" or "5." Undergraduate and graduate students also found the IT environment helpful in their learning, and their average rating was 4.00±0.07; 94 percent of them rated it a "3," "4" or "5." Clearly IT does not offer ubiquitous and unalloyed value to the scholarly community at Indiana University, especially as an aid to teaching and learning. Nonetheless, when asked about their general satisfaction with all aspects of the services UITS offers, more than 98 percent of our customers gave a Satisfactory or better rating. It would seem that UITS has two major tasks in the future: to work with the faculty and students to create better alignment of IT services with teaching and learning and to convert all those "3" and "4" ratings to "5" both on the value and satisfaction scales.

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