Information Technology Strategic Transformation Committee
UB IT Environment Team Final Report

Executive Summary

Information Technology has become an integral part of the life of all Americans. In a leading research university, the role of Information Resources[1] is even more pervasive. This situation is not unexpected. A university is society's locus for the creation, preservation and transmission of knowledge, and information is the raw material for this knowledge industry. In the contemporary world, much of this activity is enabled by technology. The university confronts a changing environment of technology and information resources – changing expectations on the use of technology, changing regulations about the use of technology. In examining the technology environment at the University at Buffalo, we must be mindful of the multiplicity of roles to which it is called.

The greatest IR asset of the University is its intellectual capital. Indeed, the institution relies on innovation and creative thinking to make its reputation. Yet our greatest weakness is the disconnect between IR planning and decision making and that intellectual capital.

We contend that IR is not simply a resource to be 'managed' in a traditional business sense. ***Rather, to the extent that the University identifies itself with innovation and creative activities, IR is an asset to be leveraged, to mark UB as a Top 25 public research university.***

The UB IT Environment Team finds that the University under-invests in technology and IR, relative to leading public research universities. The University IT effort is short-staffed for the number of faculty on campus, compared with support numbers at other leading public research universities. Given this under-spending, the challenge for the campus is to develop an institutional culture that brings about an environment of collaboration and cooperation.

> *"The key to future competitive advantage will be the organization's capacity to create the social architecture capable of generating intellectual capital."*[2]

Can the leadership of the University foster the milieu in which creativity can thrive?

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[1] Information Technology is the most commonly used rubric to describe the computer, network, software and other data resources. Especially on a university campus, given the large role of libraries and other data repositories, we suggest that Information Resources might be a more apt descriptor. Reflecting this expanded role, we mostly refer to IR in this document, although IR and IT may be viewed as largely interchangeable.

[2] In "The Leadership Advantage" by Warren Bennis, *Leader to Leader*, No. 12 Spring 1999

The Team summarizes all findings in the document entitled "Potential Opportunities" attached to this Report, a list of actions and areas by which a change in operation may better position UB's IR activities. Each "opportunity" must be fully explored and evaluated – both on its own terms and relative to the other "opportunities" – to determine its net realizable effect. This list is designed to suggest ways to free staff time from routine activities, allowing them to assist faculty with the research and instructional activities that bring distinction to the University. Moreover, several of the opportunities should be viewed as interdependent, making sense only if the other opportunities in that suite are also adopted. Four areas drawn from that opportunities list deserve special mention.

1. **Governance** The most revolutionary opportunity for change in the campus IR operation is to establish a broadly-based and transparent governance structure for UB. This governance structure must transcend the central-distributed divide, engaging the senior leadership and the deans and VPs while being attentive to the voice of IR staff and the end users – the faculty, professional staff, and students.
2. **Administrative Systems** By far, the area offering the largest potential gain in efficiencies and productivity is administrative systems. The campus has stated clearly that it is looking for a comprehensive solution to this challenge, a solution that integrates personnel and financial systems with appropriate connections to student systems. Piecemeal fixes will not answer the campus' demand for improvement. At the same time, addressing the needs in administrative systems cannot preclude progress on other recommendations that also must be supported.
3. **Workstations** The provisioning of workstation services, including purchasing, imaging, security, patching and backup could be profitably restructured. We recommend the campus adopt an IT Bill of Rights that provides a well communicated support model for workstation users, that guarantees a minimal refresh cycle for hardware and software, establishes basic faculty/staff workstation standards, and defines and employs standard images (which can be customized for specialized needs) maintained centrally for all machines while retaining a diversity of computing platforms and operating systems. These changes must be viewed as interdependent.
4. **Core Activity Support and the Support Staff** Further changes to the operation of information resources should be undertaken, the goal of which is to expand and improve support services for core research and instructional activities, by freeing existing support staff effort, by developing the skills of all staff members, and by targeted new investments in support staff. Efficiencies and improvements may be found in: (i) expanded and improved instructional and classroom support services, (ii) expanding the offering and use of the server "club room", together with offering a robust suite of software for remote server management, (iii) consolidating web services, including marketing and web publication services, together with a flexible service agreement; (iv) developing a consistent IT staff position description system, compensation system and promotional plan; (v) expanding the opportunities for professional development for IT staff.

Information Technology Strategic Transformation Committee
UB IT Environment Team Final Report[3]

As our case is new, so we must think anew and act anew.
A. Lincoln

Introduction

Information Technology has become an integral part in the life of all Americans. In a leading research university, the role of Information Resources is even more pervasive. The IR environment at the University at Buffalo is a complex array of hardware, software and personnel that serve the varied needs of the campus through a mix of central and distributed resources and staffing. This situation is not unexpected. A university is society's locus for the creation, preservation and transmission of knowledge, and information is the raw material for this knowledge industry. In the contemporary world, much of this activity is enabled by technology. At the same time, the modern university is a large business, and must manage facilities, pay employees, comply with regulatory policies, and communicate among its own and to the outside. Here too, technology plays a role in mediating these functions. Moreover, both in its role as a generator and curator of knowledge and in its role as a business and employer, the University confronts a changing environment for technology and information resources – changing expectations on the use of technology, changing regulations about the use of technology. In examining the IR Environment at UB, we must be mindful of the multiplicity of roles to which IR is called.

Even as technology is called upon to do more for the administrative operations of the university, even as all information resources are more tightly coupled into the instruction and research enterprise, budgets for IR are under increasing pressure. This is especially true at public universities, where state budgets do not adequately support the real costs of educating her citizens.

Confronted by a myriad of activities into which technology and information resources are drawn, expenditures on IR are often made without an understanding of the needs and goals of the university as a whole. Precisely because of the expanding capabilities of technology and IR and the increasing demands for its use, choices made for investment fundamentally impact the institution's ability to meet its objectives. The challenge for UB is to think beyond simply managing technology, to embrace leadership that reshapes IR processes, strategies, and finances, to improve institutional outcomes.

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[3] Several references were used in writing this report. These include: "Layer 8: A White Paper on Managing Information Technology Investments to Advance NC State's Mission" by S. Stein, S. Avereitt and H. Schaeffer, http://www.ncsu.edu/it/cmptplans/layer8/ , "How the Top 25 Universities use Information Technology and Services to Support Research", R. Muenchen, and "Road to Information technology Excellence'' http://oit.utk.edu/rite/RTE%20HTML%20Version%209.060402.htm, "Plan IT", http://cio.osu.edu/planit *A University for the 21st Century*, J. Duderstadt, "The Campus Computing Project", ECAR, http://www.educause.edu/ECARSubscribers/960?ID=79655 . In addition, existing UB data sources were consulted.

In order to address the role of IR on campus, let us define a vocabulary. Following the ideas of the IT Information Library, one may classify IR activity at an institution under one of two headings: *utility* and *core.* Utility is the regular business of the institution – purchasing goods and services, appointing personnel, sharing documents. Core consists of those activities that make the institution distinctive, giving it a competitive edge – leading research and instructional practices being the principal components here. Gartner Inc. estimates that among all organizations, on average 78% of effort goes to utility work, and 22% to core activities. The fundamental challenge for the University, then, is to make utility work as efficient and effective as possible, in order to free time and money to devote to core activities.

We contend that IR is not simply a resource to be 'managed' in a traditional business sense. ***Rather, to the extent that the University identifies itself with innovation and creative activities, IR is an asset to be leveraged, to mark UB as a Top 25 public research university.***

One further comment is in order – to place in context the kinds of changes likely to result from this Strategic Transformation Process. For any organization, because a relatively small fraction of time is devoted to core activities, any streamlining of utility work provides a significant (relative) addition to the core. For example, using Gartner's estimates of ~80/20, a 5% reduction of utility effort yields 4% of additional capacity; adding this capacity to core results in a 20% increase in time devoted to those activities, a large increase in those efforts that bring distinction to the University.

Diversity in IR

Consider a typical day for employees of the University:

- A faculty member may spend the morning monitoring an online assessment of her students using a course management system, writing a review of a manuscript, and catching up on e-mail. After lunch, she logs into the network and sets up her experimental procedures: examining in real-time of images of protein structures from the Brookhaven x-ray beam, launching of numerical simulations of promising atomic arrangements, and moving and storing all the data.
- After spending the morning unraveling the statistical results of his survey data, the associate chair in the department uploads a grant payment request and then calls up the electronic course evaluation results to prepare a report for the faculty meeting later that afternoon.
- A member of the dean's staff spends the day checking personnel listings, writing a script that queries the central HR database and compares output to a local database he developed. Mismatches are flagged for follow-up.
- An administrative assistant in a department spends time clearing up course registration problems, then updates the department accounts. Her afternoon is spent on the phone with the sponsored programs office and grants and contracts, reviewing proposals and award expenditures.
- In the morning a node IR manager talks with his staff to address a difficulty with one of the school's specialty public student labs. He acts to clear a backlog of

service calls. In the afternoon he meets with his web team to design the layout of and data structures for a new web site the dean has requested.

During this typical day on campus, routine use of internet applications is intermixed with network use requiring high quality of service, simple computing needs with high performance computing applications, all of this along with programming, scripting, databases access and videoconferencing. Such is the diversity of a 35,000 person campus.

Contemplating all of these activities and understanding the investments required to enable and support them, and properly positioning the University for an unknown future of technology developments, necessitates that IR leadership is better connected with the campus and more fully integrated into a university-wide process for decision-making. An IR management and accountability strategy must respect diversity while striving for efficiency and effectiveness. For example, while it might lower costs for the campus to standardize on a single brand of workstation and operating system, such a decision would cripple the scientific and scholarly pursuits of entire disciplines. Thus an examination of IR functions to determine those that might be better served by consolidation must also determine those which are best provided by a decentralized and diversified support model. In other words, understanding the impact of any decision on the mission and goals of the University – appreciating what is core and what is utility – is integral to the success of the institution in gaining the most value for its IR dollar.

One final idea is required for a full understanding of information resources in today's environment: because of the ubiquity of technology and the intimate role of IR in the life of the institution, models for service provision depend less on the vertical structure of departments and schools and more on a horizontal layering of expertise. That is, rather than structuring a model in which every decanal and vice-presidential unit provides similar services to its own people, a more effective deployment of people and money might be for a shared development and use of selected resources coupled with local support of specialized services that add value for that area. This horizontal integration of IR services necessitates a shift in management paradigm, from one of command and control to one of collaborate and cooperate.

How we got here

At this juncture, it is timely to recall some of UB's history. In the beginning of the 1990's, technology at UB, nascent as it was, was a centralized function, with a small number of personnel working with groups and individuals in those departments that were early leaders in research computing. At this time, certain business units were beginning to develop a computing applications support structure. By the early part of that decade, small technology service organizations had appeared in the academic environment, principally in the School of Engineering and in the biomedical sciences. Nevertheless, as computing usage increased throughout the units, the expectation was for the central computing organization to meet all needs. Of course such expectations could not be met without a large investment of resources. To better serve the increasing demand for technology support and to avoid massive duplication of services, the distributed academic "nodes" were created in the later half of the 90's. Originally there were some half dozen service units, wherein schools and faculties were joined. Given the inexorable pull on the

technology staff to accommodate the special needs of the faculty members in the various schools, by 2000 many of these units had bifurcated, so that today each school/college has its own technology service organization. (A partial except is the special arrangement of the Science and Engineering Node Services supporting the natural science and mathematics departments of the College of Arts and Sciences.) The several deans support their service unit, each at a different level, through a mix of funding sources. The administrative units followed a similar trajectory as they organized technology support.

A Re-thinking of IR

In December 2004, the UB Academic Support Planning Committee conducted a survey of resource expenditures on campus. That study found information technology, broadly defined, consisting of 410 FTE employees with an 2003-04 FY expenditure of $50.6M (see the appendix for a summary). A recommendation of the Academic Support Planning Committee led to the formation of the Information Technology Strategic Transformation Committee (ITSTC), which was charged to understand better the current technology environment on campus, and to design governance, service and funding models for a newly-positioned technology umbrella. To this end, the ITSTC created the UB IT Environment and Data Collection Team, to document the existing infrastructure and staffing and its operation. All areas of IR were to be examined *except for the direct provision of research support.* Thus, although school-based resources that contribute to research (e.g. workstations, software, timeshare machines) are included in this study, the large research centers (e.g. CCR, NYSCEDII) have been excluded.

This document is a final report of the UB IT Environment Team (ITE). The narrative highlights our central findings. Summaries of the data findings are included as appendices.

What we did

The ITSTC instructed the ITE to collect data on all aspects of technology on campus, except those activities that were directly research technology. The ITSTC enumerated approximately a dozen technology issues that, it was believed, required more careful examination. This list was prepared based on a belief that those identified issues were particularly important in forwarding campus goals, were high in cost or in staffing requirements, left the campus especially vulnerable, or might be duplicative. Financial data was reported from the 2003-04 fiscal year.

The Team was guided by a set of principles for the delivery of services to the campus:

- IR does not exist for itself—IR is a service organization for faculty, staff and students
- IR must be aligned with the academic mission of the University
- IR is a strategic advantage for the recruitment and retention of faculty and students
- IR is a strategic asset to advance research and graduate education
- IR governance must involve the entire UB community.

Furthermore, the team worked under certain assumptions about how services are delivered:

- IR works through a *continuous improvement* model of systems and services upgrades;
- IR works as an *early follower* in new technology developments;
- IR works to strike an *effective balance* between maximum cost efficiency and highest functionality;
- IR works to *accommodate the distinctions and differences* among the academic and administrative needs.

Here we must clarify one point – although the campus is committed to working as an early follower regarding institutional IR, the ITE recognizes that the University must be on the leading – and sometimes "bleeding" – edge in some arenas, areas of distinction for UB such as bioinformatics, computational biology and computational chemistry, the simulation and mitigation of hazards.

To begin its work, the ITE team examined data that were available from other sources (e.g. the Fall '04 Service Mapping exercise, or earlier campus surveys). Following the directive of the ITSTC, the ITE designed a questionnaire to be completed by all units at the University. The questionnaire was organized into 4 sections:

1. Services
   8 questions for each of as many as 56 services
2. Service Specific
   37 questions specific to certain services, including inventory questions
3. Non-service questions
   personnel questions, software inventory
4. Narrative
   9 open-ended narrative questions

These questions were developed into an online data collection tool. The team worked through the Chief Financial Officers of all decanal and Vice-Presidential areas, and identified all other groups that needed to be contacted. The CFOs in turn involved their staff and the technology staff of their units as appropriate. CFOs were given access to the data collection tool, and in turn they provided access to their staff as they deemed appropriate.

To explain the data collection process, the questions that were being asked, and the tool that was being developed, three training sessions were held. The first was for CFOs, and held approximately ten days before the survey instrument was to be made available online. At this session, the questionnaire was given to the CFOs, allowing them to prepare necessary materials early. Subsequently two additional sessions were held for the CFOs and their technology staff. These sessions introduced the respondents to the data collection tool, and presented examples of responses. A Users Manual was prepared and made available online to respondents. An e-mail listserv for questions was created, and the ITE responded to these inquiries. After completing the survey, units were able to run

reports, to archive how they organize the provisioning of IR for themselves. In total, 94 entities, represented by 127 individuals, responded to the survey, entering 1491 records. (Not every entity on campus completed the data survey – in many cases, responses were aggregated to the level of the dean/VP.)

After the survey was completed by the campus, the ITE grouped all services into six service areas, and merged the service, service specific, non-service and narrative responses for each area. The team examined service provisioning for each area, making comparisons across units on-campus and benchmarking against other institutions (especially research extensive campuses). The team followed up with several units, to clarify specific responses.

The data

We have made every effort to verify the data used here, and they appear reasonable. To the extent we have been able to check, the data are consistent with data from other sources. Nevertheless we recognize the difficult request that was made to the CFOs. It is the sense of the ITE that the data reported, if not precisely correct, does satisfy the "80-20 rule", and we approach the analysis of this data expecting it to be about 80% accurate.

Summary of Findings

The landscape: UB Numbers and Peers Comparison We turned to external sources for data that allow for comparison (albeit imperfect) of IR at UB with IR at other campuses. In the following, we take care to note data specifically from research extensive universities, as differentiated from data from all research institutions (extensive and intensive), as differentiated from data from all colleges and universities[4]. In general, research intensive universities provide less (often substantially less) support to their faculties than do research extensive institutions, and non-research institutions provide even less support.

The tables below summarize our findings of several campus-wide metrics. We make comparisons based on data from Cornell University (an institution which was willing to share data, and which recently undertook a consolidation from a fully decentralized IT environment to a mixed central-distributed model not unlike that present here), from the Education Center for Applied Research (ECAR), from EDUCAUSE, and from peer institutions. It should come as no surprise that a large impediment to our work has been the difficulty in obtaining accurate data to enable meaningful comparisons.

Selected IT Expenditures (in thousands)

	Campus-wide	Central IT	Academic-Decanal	Academic-Other	Administrative
PSR	$26,740	$12,407	$7,072	$3,025	$4,236
TS	$2,419	$1,481	$571	$241	$126
OTPS	$24,245	$14,420	$3,352	$3,251	$3,222
Total	$53,409	$28,308	$10,995	$6,517	$7,589
IT FTE Staff	448.14	196.48	125.64	47.88	78.14

TABLE 1: Selected UB IR expenditures (in thousands) on campus and within administrative and academic units.

Table 1 presents the IR expenditures on campus in aggregate, and the breakdown of central, academic and administrative expenditures. The total of $53M is consistent with the findings of the Fall 2004 Service Mapping exercise, which showed some $51M in expenditures for IR. We mention that some areas which were separated out of IR in the Service Mapping survey are included in IR for this survey.

[4] The Carnegie Foundation for the Advancement of Teaching classification of post-secondary institutions includes research extensive schools (those who, on average, award 50 or more doctoral degrees throughout at least 15 different disciplines every year), and research intensive schools (10 or more doctorates in at least 3 disciplines, or a total of 20 doctoral degrees overall). UB is a research extensive institution, with a goal of being among the top 25 of all public research institutions (measured by annual research expenditures) in the American Association of Universities, a group of the premier research institutions in the country. UB sees as its peers and aspirants campuses such as the University of Iowa, the University of North Carolina, the University of Pittsburgh, the University of Missouri, and the University of Colorado. In the current rankings of research expenditures (2003 data), UB ranks 35th; Iowa is 29, UNC 18, Pittsburgh 17, Missouri 46, and Colorado 15.

To see these numbers in context, in *A University for the 21st Century*, Duderstadt writes that technology expenditures at large research universities approaches 10% of the total budget. The *Campus Computing Project* reports the mean for 632 colleges and universities surveyed (2002 data) is 7.3% [with a minimum at 5.1% and a maximum at 11%]. Using the Fall '04 Service Mapping data for the 2003-04 fiscal year, total expenditures at UB amount to $729M. UB spends 7.0% of its budget on IR.

Thus, although campus expenditures on information resources are sizeable, this campus under-invests in IR. ***The University at Buffalo spends a smaller percentage of its smaller budget on IR, relative to peers.*** This fact exhibits itself in the small size of IR staff for a campus of this size and with its stated aspirations.

	Campus IT Professionals: Headcount or (FTE)	**Central IT Professionals: Headcount or (FTE)**	**Student Enrollment**	**Faculty FTE**	**Ratio: Students/ Central IT Staff**
Cornell	733.6 (FTE)	268.8 (FTE)	20299	2627	75.5
Indiana-Bloomington		469	37821	2251	80.6
Iowa		221 (FTE)	29745	1200	134.6
Illinois –Urbana Champaign		261	40360	2578	154.6
Maryland College Park		267	34933	3630	130.8
NC State	427	93	25009	1624	268.9
Ohio State U		320	50995	3373	159.4
Penn State – University Park		464	41738	3585	90.0
UB	448	196	27276	1365	139.2
UC Berkeley	845	272	29300	3127	107.7
UNC - Chapel Hill	1024	384	26359	3058	68.6
Washington-Seattle		425 (FTE)	39323	3847	92.5
Wisconsin- Madison	>1100	578	40438	3253	70.0

TABLE 2: Benchmarking IR at Elite and Peer Public Universities and Cornell based on 2003 ECAR survey data. Cornell is not a peer institution, but it has just completed an extensive campus technology workforce study, and its findings are appropriate for this study. Blank entries are where Campus IT Professionals data is not known, and should not be construed as being 'zero'.

Table 2 compares staffing at UB with top public universities and with Cornell. The number of IT staff in the distributed units is not available from many institutions (ECAR and EDUCAUSE 2003 summary data report). For those reporting only central staff, the comparison to be made is with UB's central staff

And what might be the correct size of IT staff at a research university? In their Plan IT, Ohio State University offers:

> *The university must also develop technical staff with diverse skills to provide more help to faculty on technology problems in research labs. A working estimated support ratio is one technical staff member for every 15 research faculty.*

Towards a similar end, ECAR writes in the 2003 core data summary:

> *Highly complex, large, research-oriented institutions have a greater need for specialized, often disciplinarily trained IT staff in the departments and colleges to support faculty.*

Table 3 shows the ratio of faculty to the distributed IR staff in the academic units (that is, the staff who support research faculty). As one sees, the support of faculty varies widely by school and size. Total staff in the school is also included in this table, because the academic node personnel do provide support for the decanal and departmental staff. However these staff numbers are not included in the faculty-to-node staff ratio. The reader can estimate the effect of the decanal staff numbers on this support number.

	Faculty FTE	**Faculty HC**	**Decanal Staff**	**Decanal IT HC**	**Faculty HC/IT Support Staff HC**
CAS*	360.01	670	230	21	24.8
Architecture	33.00	63	19	4	15.8
Dental School	106.36	189	140	10	18.9
Education	73.13	143	36	7	20.4
Engineering, including CSE (supporting SEAS and NSM)	259.73	160	93	21	14.8
Informatics	23.00	37	15	2	18.5
Law	61.89	108	48	4	27.0
Management	64.92	88	44	5	17.6
Medicine	239.98	494	120	16	30.9
Nursing	36.08	40	18	5	8.0
Pharmacy	36.94	44	21	7	6.3
Public Health	50.65	72	27	8	9.0
Social Work	20.00	51	26	5	10.2
Totals	**1365.69**	**2159**	**837**	**114**	

TABLE 3: Ratio of faculty to distributed IT staff, by school, corrected for SENS support of Natural Science/Mathematics*

Table 4 benchmarks UB's central technology staff size normalized by the number of students at the institution. The Campus Computing Project is from their 2002 survey data of 632 public colleges and universities. UB's number, close to the ECAR (research) mean must be triangulated against the ratio at research extensive schools, which tend to be smaller than the reported averages at all research institutions. To this end, comparison with Wisconsin is especially meaningful (and more typical of research extensive institutions).

Comparative Metric: Staffing Ratios UB, Cornell, ECAR DR
Students Supported per Central FTE IT Staff FTE

	UB	Cornell: 2003	Wisconsin-Madison 2005	ECAR 2003: All DR, Mean, Median, Min, Max	Campus Computing Project 2002: All Public Universities
Mean	139.2	75.5	71.2	122.8	122.4
Median				117.4	
Min				0.1	
Max				1320.4	

TABLE 4 Ratio of students to central IR staff at UB, Cornell, Wisconsin, from ECAR data for all doctoral institutions, and the Campus Computing Project mean.

Table 5 compares UB's central and distributed technology staffing levels against Cornell, Wisconsin, and ECAR data. Again care must be exercised in making comparisons with ECAR doctoral averages.

	UB	Cornell: 2003	Wisconsin-Madison 2005	ECAR 2003: DR EXT Mean	ECAR Median	ECAR Min	ECAR Max
Total Campus-wide FTE IT Professional Staff	448.14	733.60	>1100	390.40			
Central IT: FTE	196.48	268.80	578.00	205.10	176.40	39.00	657.00
Central FTE IT Staff as a Percentage of Total Campus FTE IT Staff	43.8%	36.64%	-	52.50%			

TABLE 5: Total Professional IR staff, central and distributed, and comparisons.

A fuller comparison with Cornell is possible because the necessary data is available. Although a private institution, Cornell is an in-state competitor for students and faculty. Clearly Cornell provides significantly more staff support for the campus as a whole, and especially for the research faculty.

	UB	Cornell: 2003

Campus-wide	448.14	733.60
Central IT Organization	196.48	268.80
Academic- Decanal	125.64	246.60
Academic-Other	47.88	95.90
Administrative	78.14	122.40

TABLE 6: Distribution of IR staff, UB and Cornell

	Central IT staff as % of Total Campus IT staff
NC State	21.78
UB	43.84
UC Berkeley	32.19
UNC	37.50

TABLE 7: Central IR staff as a percentage of total IR staff at peer and elite public universities.

Table 7 provides data on central staff as a percentage of total campus staff at peer and elite publics. Clearly UB has a heavy percentage of central IR staff. Given the smaller size of the overall staff, relative to Top 25 publics, this skewing reflects the underinvestment in staff within the distributed units.

Taken together, these tables indicate that UB has a small IR staff compared to leading research institutions. The staff shortage is more acute in the distributed nodes, where staff members interact directly with faculty members, ensuring their machines are appropriately configured and that they have access to the tools and data they require, and that teaching labs are functioning properly.

Data Collection Findings

Personnel Table 6 provides a summary of IR staffing by administrative unit. For purposes of the staff inventory, full-time IR staff was defined for survey respondents as those working more than 50% on IR activities. The FTE figure includes faculty and non-IR staff who perform IR work and non-IR staff who spend a significant fraction of their time on IR. These FTEs are asked to perform a number of tasks, distributed as indicated in Table 8.

The average workweek of the full-time staff is 43.3 hours, which means that each week, every staff member, on average, works three-quarters of a day beyond her required time (based on the official 37.5 hour workweek). In addition to this 15% staffing shortfall, follow-up questions suggest that the 43.3 hour figure does not include incident management effort and regular status checking from home, nor does it include the on-call hours of the staff. Furthermore, based on vacation time and sick leave data over the past 3

years, IR professional staff accrue vacation time at four times the rate of non-IR staff, and accrue sick time at three times the non-IR staff rate. These figures suggest the difficulties that IR staff encounters in scheduling normal and healthy time off, and, as a consequence, vacation time and sick days are not being used by the IR staff.

Service Category	**FTE**	**%**
Administrative Management & Support	37.61	8.39%
Data Warehousing	7.72	1.72%
Instruction and Research	5.58	1.26%
Instructional Support	40.42	9.12%
Application Support	98.91	22.07%
Admin/Finan/Bus	75.18	16.78%
Academic	23.73	5.35%
IT Consulting	46.64	10.52%
IT Printing	3.05	0.69%
Network Admin	20.21	4.56%
Server Admin	102.08	23.04%
Telephone Services	11.77	2.66%
Workstation Support	47.37	10.69%
Web Publishing	26.78	6.04%
	448.14	

TABLE 8: IR staff service responsibilities and the aggregate percentage effort on those services.

Narrative responses echo the finding that IR staff members are being overstretched. One response says “[staff] can do only what they absolutely must, not what they could do to enhance IT services supportive of faculty, staff, and student activities and priorities”. The Data Collection Questionnaire asked respondents what are their three greatest challenges. The most cited responses to the question were:

- insufficient funding
- insufficient staffing
- heterogeneity of support needs
- security

Written comments accompanying this question make clear that respondents were challenged by the heterogeneity of support and by security issues because they did not have sufficient staffing to properly meet these service needs. An application inventory was requested in the survey, and shows that across all units, on average 7.8 widely used application suites are supported, and, on average, 4.5 other application packages are widely used in the unit but more specialized in nature. Among the academic service units especially, these numbers can be 30% larger or more.

The narrative comments also suggest that the IR staff workload has had a significant impact on morale. Moreover, the challenge of supporting more services without adequate levels of staffing precludes taking time for professional development, further stressing the staff. Having the time and resources for professional development is a concern voiced clearly in the narrative responses. One comment reads “Without sufficient staff, there is

not proper time to dedicate to training and therefore the level of expertise of the staff decreases rapidly."

In addition to the full-time staff, the campus employs students to the tune of 156.3 student FTEs. These students do desktop support and work the Help Desks, perform classroom support services, do application development and web support, take orders, and back-up and restore data, among other functions. It is clear that IR support would drown if not for the student assistance.

Finances and Governance As a campus, $53M is spent on IR services, of which approximately $13.4M is spent in the academic units, $32.3M in CIT, and $7.3M in the other administrative units.

Principal feedback on financial decision making was garnered from the narrative questions. Insufficient funding for IR projects is a major challenge for the units. Decisions regarding IR funding are made in different ways in the decanal/VP units, and it is not always clear how input is provided into this decision making. A more transparent process would benefit the end users.

Not only is funding deemed insufficient, but it also lacks predictability that could support better planning over time. In the distributed community, the deans and vice-presidents have not invested in technology and staff equally. At the same time, the distributed IT staff "has such a broad scope of responsibilities that it is difficult to retain a high level of service with limited funds". Thus a reliable campus funding model for IT is needed, one that incorporates the concerns of the entire campus.

Survey questions probed respondents' impressions of IR governance. Respondents strongly agreed with the statement "UB needs a comprehensive institutional IT governance and planning process". From the narrative comments, the campus indicates there is a lack of a clear definition of IT staff/organization roles and responsibilities, resulting in friction about who should be doing what. Responses say that central leadership does not understand the needs of the distributed community, and feels the central organization needs to involve the distributed community more in decision making. Other comments note the need for better communication throughout the IR community.

Administrative Systems

> *Having to work around the central systems' data problems/issues has resulted in the need for the school and department's shadow systems.*

This quote from a narrative response describes the overall status of back-end administrative systems at UB. Regarding financial systems, responders say that tracking financial commitments, forecasting, and reporting on all funds are the primary reasons they maintain their local systems. Respondents state their desire for a one-stop location to service their needs. They perceive the current system as outdated. Responding to HR systems, respondents state the central systems are antiquated. Of greater concern, respondents question the reliability of the data supplied by central systems.

In total, $10.5M – about 20% of the total IR budget – and 162.5 FTEs – about 36% of the FTE staff – are devoted to administrative applications, including application development, data warehousing, procurement, HR and financial systems, marketing and web activities. In some instances, these systems were designed and developed by staff and/or students who are no longer here, which adds to the difficulty of supporting legacy systems. Not surprisingly, the bulk of Administrative Application activity resides in the administrative units and not in the decanal areas. At the same time, the bulk of Administrative Application activity is done in the distributed units, not by the central IT organization.

As noted earlier, according to narrative responses much of this effort in the distributed units consists of supporting and using shadow systems. Further evidence comes from the application inventory, which shows almost three-quarters of all the entities responding support a locally developed HR, financial or student application. Almost universally, across all system areas, the main reasons given for maintaining distributed shadow systems include increased functionality tailored toward the customer, better quality of service and better control of how this service is provided. Additionally, providers of financial services and systems cite needs for All Funds reporting, budget forecasting and commitment management as reasons for their local systems. Given the pervasiveness of these shadow systems, it is often difficult to define the "system of record" for the campus. Clearly, the inadequacy of the administrative systems is driving units to spend considerable resources to perform what ought to be a central data and application service.

Application development is the costliest of the services within the administrative systems arena, with 29 units providing this service, 47 FTEs, and a total cost of $2.8M. Of these 29 units, 16 indicated that they supplied applications to areas outside of their organization. Narrative responses and comments indicate units are struggling with applications developed by students or staff who then leave, without the unit gaining an understanding of the maintenance of the application.

Across campus there were 53.29 FTE involved in the support of web-based services at a cost of $2.5M. In the broad arena of Marketing /Public Relations/Web Publication Production, Design and Implementation, there are 35 providers, 38.1 FTE, and $1.6M spent. Comments indicate that providing quality and understanding the local environment are the key reasons the local units provide this service. A related service is in Web Server Administration. There are 26 service providers of this service, almost all of whom are involved in the development and maintenance of their departments' web sites. The questionnaire inquired about the use and satisfaction of the central web hosting service (Wings). There were 30 responses, 14 of whom indicated they do not use Wings, and 4 responses indicating satisfaction with that service. The principal reasons for dissatisfaction with Wings include the desire for more control, the lack of a development environment, the need to move toward a more "commercial grade" service, and a lack of support for IIS.

Instructional Support The CIO Office supports a total of 131 classrooms and labs equipped with differing technology. Of these, 8 are centrally scheduled or open access computer classrooms and teaching labs (i.e. classrooms with a workstation at every seat), for general instruction. A total of 68 classrooms are Technology Classrooms, as shown in Table 8. The majority of these classrooms have a robust suite of technology provided – computers, video projector, internet connection, visualizer, DVD/videotape player, and laptop plug-in. Six of the 53 North Campus sites are 'IT Lite' classrooms, with similar equipment but no computer.

The distributed IR units support perhaps as many as 100 classrooms and labs (exact numbers are not available, as is the precise level of support and service coverage for all of these classrooms). Of these, 63 are computer classrooms and teaching labs, many of which feature specialty software or configurations specifically designed for the discipline. There are a total of 43 Technology Classrooms supported by the distributed units.

Approximately 33 FTEs are devoted to providing classroom technology services, about 25 of whom are in the CIO Office; 40% of the CIO FTEs are professional staff, and 60% student assistants.

Narrative comments indicate a desire on the part of faculty members for more technology-enabled classrooms (i.e. rooms equipped for digital presentations). The distribution of these rooms, by geography and by size, is shown in Table 8.

Technology Classrooms	**North Campus**	**South Campus**	**Total**
Centrally Scheduled Classrooms	53	15	68 (54% of all centrally scheduled classrooms)
Departmental Classrooms	31	11	42 (plus 1 at the Butler Mansion)
Distribution of centrally scheduled classrooms by size	**North Campus**	**South Campus**	**Total**
<30 seats	7	0	7
31 – 60 seats	22	7	29
61 – 100 seats	13	0	13
101 – 200 seats	3	5	8
> 200 seats	8	3	11
Grand Total	53	15	68

TABLE 8: Count of technology enabled classrooms, and the distribution of classrooms by size.

In addition, many respondents cited the need for expanded wireless access.

Approximately 33 FTE are devoted to providing classroom technology services, about 25 of whom are in the CIO Office; 40% of the CIO FTEs are professional staff, and 60% student assistants. Approximately $2.2M is spent on technology classroom support services, $1.3M from the CIO office and $0.9M in the academic units. The personnel portion of this total (PSR and TS) comes to slightly over $1M, the remaining $1.2M being OTPS costs. Neither the total cost of this service nor the central-academic breakdown of them is surprising, given the multiple objectives that must be considered.

Online and Distance Learning Online course management efforts require 5 FTE and $425,000. These expenditures are largely in the Office of the CIO, but several schools and the libraries provide this support. The Schools of Dental Medicine, Nursing and Social Work have significant expenditures in support of course management on campus. Typically these expenditures augment UBLearns for school specializations. The School of Law runs "Destination Point", a "collage of web-based applications that conjoin the academic and administrative services in the academic environment". UBLearns appears to be widely accepted as *the* campus course management system to support online learning from a centralized model

Distance learning includes 7 FTEs and $525,000. Again, a large fraction of these efforts reside in the CIO office, but the schools also provide this service. Departmental preferences are for front-end services to distant learners at the department, including a range of support services (e.g. the program offered by GSE). Distance learning support at UB is a centrally supported collaboration infrastructure (DEVO) in support of academic programs within decanal areas.

Course Evaluation Only $95,000 is reported for course evaluation, most of which is in Pharmacy. It is important to note that since the '04 year, the time of this snapshot, the College of Arts and Sciences has instituted an on-line course evaluation process. A summary of the efforts of the College is included as an appendix.

Digital Media Digital media support consumes $780,000 and includes some 14 FTE of effort. These expenditures are largely in the CIO office, but several schools and the libraries provide this support.

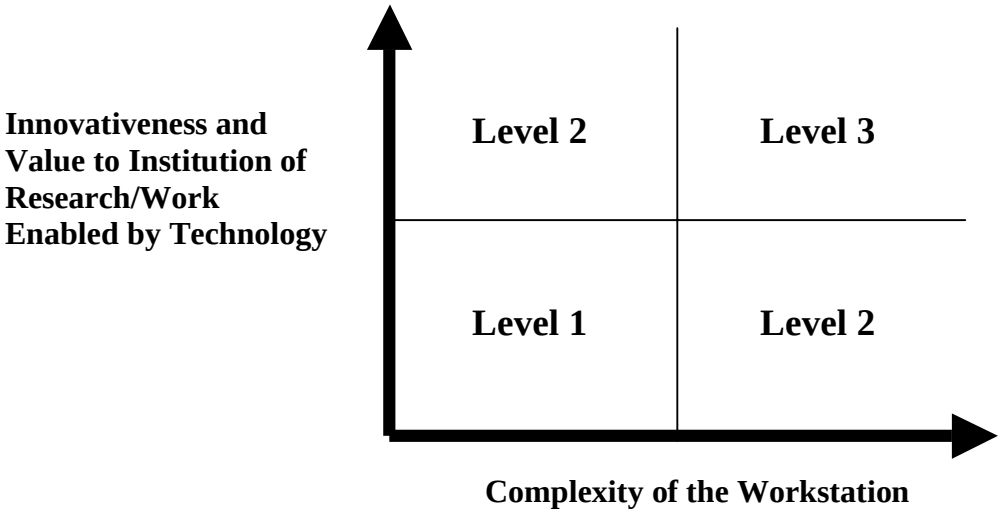
Printing Nineteen areas on campus reported expenditures for printing services, totaling $876K (not including the costs for print servers, which are tallied separately). These expenditures are dominated by consumable costs (paper, toner, etc.), totaling $614K. Some 80% of these consumable costs are expended in the CIO's area. [The campus must note that the School of Architecture and Planning accounts for 45% of printing expenditures in the Provostal area; SAP reports four student FTE and nearly one-third of one staff FTE to support printing. SAP has specialty printing needs that drive these relatively high costs for the School.] The Division of Athletics also has considerable expenditures for consumable costs: $39.7K.

The iPrint project, the centrally supported implementation of GoPrint, has the potential to further centralize printing services as departmental areas deploy this technology to

control their printing costs. On the other hand, the deployment of desktop printers is a departmental decision. IT support areas are resigned to support whatever printing decisions are made at the departmental level, although potential savings in support costs and consumables are likely if printing consolidation were practiced at departmental levels.

Workstation Support Across campus there are 15,500 workstations, of which about 84% are based on the Windows operating system, about 7% Macintosh and about 9% one of the variants of Unix. Within each of the OS categories, machines are of differing levels of customization, and used for a wide variety of purposes.

To understand these numbers requires some thought. One may recall the Ohio State goal of one professional staff member providing service for 15 research faculty members. Another perspective comes from Gartner, who provides ratios of workstation to support staff based on the complexity of the machines to be supported. The complexity level rests on the configuration and on the degree to which end user innovation and/or high productivity is a critical feature to the institution and provides a competitive advantage.



Level 1: 125:1-200:1

Characteristics: High scalability, homogeneity, very low complexity, low innovational value to institution

- Robust IT security is in place: workstations are fully managed with application deployment, version control, patch management; good backup and restore; systems are "locked down" (users do not install apps)
- Single OS with standard configuration;
- Small number of personal productivity applications
- Typical user: non-IT clerical or professional staff who require a standard configuration

Level 2: 60:1 – 100:1

Characteristics: Falls between level 1 and level 2 in complexity and need to enable end-user productivity

- Variation on the standard configuration with some customization, and some applications required
- Single OS, but enhanced value added to productivity by increased complexity of the technology
- Typical user: professional staff with financial or student responsibilities

Level 3: 25:1 – 50:1

Characteristics: High institutional value to enabling innovation/productivity of the end-user; Environment has a high degree of customization and/or complexity, very low homogeneity

- High productivity faculty/researcher using leading-edge technology in their work, or high-level administrator with high-end technology needs and requiring immediate response time. High institutional premium on enhancing the productivity of the end-user.
- Highly specialized IT services are needed, invariably customized, often with many applications; may be multiple OS system
- Discipline-specific or even multi-discipline knowledge needed by IT support staff

The ITE modeled the complexity of the 15,500 campus machines. For several units, we assumed a distribution of staff and faculty workstations in each of the Gartner levels based on unit reported support models, quantity of operating systems supported in the reporting units, and number of applications supported. We similarly categorized lab and classroom workstations by considering the different configurations reported. We then selected 5 units (4 decanal areas and 1 administrative unit), asking the IT heads to estimate the breakdown for their unit. These estimates were used to refine the modeling.

- From the campus inventory, we have 15,564 supported workstations.
- From the personnel service breakdown, 71.93 staff FTEs are devoted to workstation and consulting services[5] support.
- Modeling places these workstations into the Gartner levels of support yields:
  - Level 1 (low value/complexity): 1578
  - Level 2 (intermediate complexity): 8339
  - Level 3 (high value/complexity): 5647
- Using the Gartner ratios as a guide, this distribution of workstations implies 204-377 FTEs are required to support our 15,500 machines.
- We use 71.57 student FTEs for workstation support and consulting services, a significant fraction of which is devoted to maintaining labs and classrooms. Even if one assumed every student FTE was equivalent to a professional staff member, the total of ~143.5 FTE is still 40% below the Gartner recommended minimum support level.

[5] This staff FTE number, and the associated student number, includes effort on workstation support and on consulting activities.

Server Support There are some 773 servers on campus, consuming about 26 FTEs for support. Many of these machines are housed in sub-standard facilities, without proper cooling, power, or physical security. One response reads "Post 9/11 concerns for security, disaster recovery and privacy have exerted unfunded imperatives on an already overloaded IT staff."

Server support data are interesting only because of what services those servers support. We break server findings into categories of support functions.

Backup support A total of $306,000 is spent on backup support. As might be expected, the largest cost is in the Office of the CIO (43% of the total). However the distributed academic units spend about 37% of the $306K, of which a large fraction is in OTPS costs. In the past, there was not central backup provision, and distributed units started offering their own service. Once a central backup was begun, the distributed units already had their backup routine working and no longer looked towards the center. Even now, some units have a need to backup several terabytes of data, which is not allowed under central policy. In addition, personal workstations are not systematically backed up. If central backup is to be encouraged, careful examination of service levels agreements and a provision for personal workstation data are both necessary.

Web server A total of $393,000 is spent on web server support. Of this, $225,000 is in the Office of the CIO, and $141,000 in the provost area. The main reason distributed units have moved away from the central web environment is that the current central web structure does not meet the many and varied needs and demands of the distributed units. Any consolidation effort must consider restrictions on content management licensing, and the significant costs – both in dollars and staff anxiety – of any transition.

Calendaring A total of $65,000 is spent on providing calendaring services, almost half of which is in the academic units. The main reason the distributed units use a de-centralized calendar system is due to the varied needs and demands present. It is important to note that when the MS Exchange service was implemented seven years ago, there was a decision made not to develop a central implementation of the exchange service, resulting in no central calendar option. The University currently licenses and supports Oracle's Corporate Time calendar.

e-mail A total of $1.1M is spent on e-mail services throughout the campus, more than 85% of which is from the CIO office. Given the service changes since 03-04, it would not surprise us if costs have grown. Several independent e-mail services are provided, many to integrate calendaring functions. There are mail servers that were initially set-up to provide larger quotas and, as indicated by responses, a more reliable service. These concerns remain at the crux of any effort to move towards consolidation of e-mail.

Print and File Servers A total of $591,000 is spent on print and file services. Print and file servers are used extensively across campus, with the costs split about evenly between the central organization and the distributed community. Oft-cited reasons for developing

file services include small quotas and limited services available for certain OS platforms. Centrally supported file services offer better data back-up and recovery options. The technical aspects of providing a consolidated file service even for multiple operating system platforms, while not simple to overcome, nonetheless could be put in place. If such a consolidation were to transpire, some standards pertaining to these different Operating Systems may be appropriate, and appropriate protocols developed.

Printing services have a different value to the customers. We did not request detailed data from the campus, because of the advanced stage of planning the campus iPrint project. It is clear that, to be successful, such a project must include, in all aspects of the deployment, the entire campus community, down to departmental printers.

Hardware and Software Respondents were asked whether their server rooms were physically secure and equipped with adequate power and cooling. Especially in the academic support units, only a few have space that is tailored for servers. Several respondents, again mostly in the distributed academic community, do not feel that they have adequate server space for expected growth over the next three years.

The IR staff likewise support an array of software packages, including anti-virus and security suites, web design and browsers, mathematical and statistical packages, CAD and design tools, visualization, programming tools, reporting tools, and Citrix, in addition to the MS Office suite, and a host of locally developed applications for HR, financial and student systems.

Hardware Repair Just over $400,000 is spent on hardware repair. The Provost and CIO each spend about 35% of this total. There has never been a central process or policy for hardware repair and/or replacement. Units had to purchase their own equipment and use inventive means to provide for support.

Telephony and Networking The campus employs 11.8 staff and 4.4 student FTEs in its telephone and networking operations, spending approximately $614,380 in PSR, $62,326 TS, and $534,4654 in OTPS dollars. The bulk of these costs reside in CIT. Distributed units support PBX and similar systems to provide dial tone to users. A total of 75 phone systems are deployed across the campus. Knowing there has been extensive collection of data on phones and networking, the ITE did not pursue a full survey of this arena.

Security Intrusion from outside is a never-ending battle fought constantly by the central and distributed units. There have been thousands of compromised machines over the past year. The increasing effort on protection and on recovery limits the ability of the staff to take on new initiatives. Security efforts were divided into proactive and reactive. Proactive security costs were $519,685, involving 4.9 staff FTEs and 1.6 student FTEs. Just under $350,000 of these costs are in the CIO office. Reactive measures cost $102,478, involving 1.3 staff FTEs and .35 student FTEs. Total expenditures on security appears modest and are almost certainly inadequate, given the size of the institution, the dispersion and diversity of IT resources, the risk environment in which the University operates, and the potential costs of not confronting the risks.

Business Continuity The University spends $364,233 on business continuity/disaster recovery planning. It appears that expenditures on business continuity/disaster recovery planning are significantly inadequate other than in the central IT organization, given the size of the institution, its dependence on IT resources, the risk environment in which the University operates, and the potential costs of not planning for the potential consequences of those risks.

Seventeen different units report machine room management outside of the Club Room space provided by CIT. There is a question of how well provisioned these rooms are, for back-up electrical power or fire preventive/retardant facilities.

Identity Management A total of $792,118 is spent on this service, more than 90% of which is by the central IT organization. There is little to be gained by consolidation of this service, but attention should be given to ways to lessen the burden on the distributed staff yet further.

Recommendations

For time and the world do not stand still. Change is the law of life.
And those who look only to the past or the present are certain to miss the future.

J. F. Kennedy

The greatest IR asset of the University is its intellectual capital. Indeed, the institution relies on innovation and creative thinking to make its reputation. Yet our greatest weakness is the disconnect between IR planning and decision making and that intellectual capital. Successfully re-engineering our IR processes will require greater involvement of the "core" constituencies. More fundamentally, the challenge is to develop an institutional culture that brings about an environment of collaboration and cooperation. Bennis writes it this way: "The key to future competitive advantage will be the organization's capacity to create the social architecture capable of generating intellectual capital."[6] Can the leadership of the University foster the milieu in which creativity can thrive?

We summarize all findings in the document entitled "Potential Opportunities," a list of possible actions that deserve examination as areas in which a change in operation may better position UB's IR activities. Each "opportunity" must be fully explored and evaluated – both on its own terms and relative to the other "opportunities" – to determine its net realizable effect. Our language should not prejudice a determination about these potential opportunities – a cost/benefit analysis must determine whether any change does result in a greater ability to provide "core" services to the campus, and any decision to proceed must respectfully address those elements that are the key to making a change successful. Moreover, several of the opportunities should be viewed as interdependent, making sense only if the other opportunities in that suite are also adopted.

We mention four areas, drawn from the opportunities list, that deserve special mention.

1. **Governance** The most revolutionary suggestion for change to the campus IR operation that emerges from the Data Collection effort is to establish a broadly-based and transparent governance structure. This governance structure must transcend the central-distributed divide. It must engage the senior leadership and the deans and VPs. It must hear the voice of IR staff, and the end users – the faculty and professional staff. It must be flexible enough to adapt to the changing priorities of the University. It must be strong enough to wring efficiencies where possible in order to invest in the core activities of research and education. At the same time, the deans and vice-presidents should constitute an advisory structure for their own units, including a representation of end users, to make recommendations on IR expenditures and projects for the unit to undertake.
2. **Administrative Systems** By far, the area offering the largest potential gain in efficiencies and productivity is in administrative systems. <u>The campus has stated clearly that it is looking for a comprehensive solution to this challenge, a solution that integrates HR, personnel and financial systems with appropriate connections to student systems.</u> Piecemeal fixes will not answer the campus' demand for

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[6] In "The Leadership Advantage" by Warren Bennis, *Leader to Leader*, No. 12 Spring 1999

improvement. A steady and deliberate approach is required. Be assured, we are not advocating an Enterprise Resource Planning (ERP) solution. But we are promoting an integrated approach to solving a systemic problem. That said, the campus must recognize that the principal feature of any change in administrative systems is not technology. It is a change in the workflow processes. The technology enters as a factor only after a restructured workflow is accepted. Improvements in administrative systems services will not only affect campus IR, but these improvements would also benefit administrative staff throughout the University. As a utility service, addressing this challenge will create capacity among the IR staff, time and resources to spend in core services. Staff members could stop creating and running shadow systems, and concentrate on the work they were hired to do. We do not underestimate the challenge of re-engineering the administrative systems. It will be costly. It will require extensive collaboration among the central IT organization and many components of the campus (HR, financial, and personnel staffs, the distributed IR staffs, administrators), a breadth and depth of cooperation hitherto unknown. At the same time, addressing the needs in administrative systems cannot preclude progress on other initiatives that must also be supported; to do so would only further impede UB's efforts to make information technology an asset propelling research and instruction.

3. **Workstations** The provisioning of workstation services is woefully under-staffed and under-funded by any measure. Staffing levels should be increased. At the same time, workstation services, including purchasing, imaging, security, patching and backup could be profitably restructured. We recommend the campus adopt an IT Bill of Rights (attached) that provides a support model for workstation users, that guarantees a minimal refresh cycle for hardware and software, establishes basic faculty/staff workstation standards, and defines and employs a standard image (which can be customized for specialized needs) maintained centrally for all machines while retaining a diversity of computing platforms and operating systems.
   A central-and-distributed user support model should include:
   - a campus-wide machine patching service;
   - a central workstation data backup service that is responsive to local needs and is robust and secure enough to back up instructional, research and administration data stored on workstations across campus;
   - a centrally managed security support system that is responsive to local needs.

   These changes must be viewed as interdependent.
4. **Core Activity Support and the Support Staff** Further changes to the operation of information resources should be undertaken, the goal of which is to expand and improve support services for core research and instructional activities, by freeing existing support staff effort, by developing the skills of all staff members, and by targeted new investments in support staff. Our examination of data suggests that efficiencies and improvements may be found in: (i) expanded and improved instructional and classroom support services, (ii) expanding the offering and use of the server club room, together with offering a robust suite of software for remote server management, (iii) consolidating web services, including marketing

and web publication services, together with a flexible service agreement; (iv) developing a consistent IT staff position description system, compensation system and promotional plan; (v) expanding the opportunities for professional development for IT staff. We note that each of these changes will carry a not inconsequential cost of transition from the current mode of operation to a new one. It must be verified that these transition costs will be amortized quickly enough to make the effort worthwhile to the parties. The action of engaging the campus, to determine need, to plan, to effect changes, all will aid in the growth and evolution of the governance structure.