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MEMORANDUM

TO: James Penner-Hahn, Laura Patterson, Dan Atkins

FROM: Jim Duderstadt

DATE: July 1, 2013

SUBJECT: Some (belated) Observations on the IT Strategic Plan

Some General Observations

First, some personal history: In the early 1970s, when I was working in the area of laser-driven thermonuclear fusion at Lawrence Livermore National Laboratory, I was allocated an hour a day of computation time on their CDC 7600, then the fastest computer in the world at 10 MFLOPS. Today, my colleagues in DOE's CASL Innovation Hub are running their simulations on the TITAN computer at Oak Ridge, at 16 PFLOPS. Hence, over the past four decades, computation speeds have increased a billion-fold. In fact, most characteristics of this technology are continuing to evolve exponentially at rates of 100 to 1,000 fold per decade. CASL is already developing its nuclear system computer codes for the anticipated delivery of an exaFLOP supercomputer in the next five years, so the trend continues.

This is one of the big reasons for the continued surprises we get from the emergence of new applications—the Internet, social networks, big data, machine learning—appearing in unexpected ways at an ever faster pace. We have learned time and time again that it makes little sense to simply extrapolate the present into the future to predict or even understand the next “tech turn”. These are not only highly disruptive technologies, but they are highly unpredictable. Ten years ago nobody would have imagined Google, Facebook, Twitter, etc...and today, nobody really can predict what will be a dominant technology even five years ahead, much less ten!

Fortunately, the University of Michigan has been able to respond to such rapid technological change in the past—and, indeed, achieved leadership—because it has functioned as a **loosely coupled adaptive system** with many of our academic units given not only the freedom, but also the encouragement, to experiment and to try new things. We have intentionally avoided the dangers of centralizing these activities, although every once in awhile someone tries to recentralize, e.g., riding the MTS

mainframe model while the rest of the world was switching to minicomputers (PDPs and VAXs) and microcomputers, or overly constraining university-wide IT with models appropriate for the business world but highly constraining, indeed disastrous, for research and teaching. We must be very careful to learn from these past mistakes and not go down these roads again.

To be sure, the tension between centralization (whether MTS or "rationalization") and decentralization (where cacophony leads to innovation) can be very threatening, particularly to those parts of the University that need to make the trains run on time (e.g., financial services, hospitals, etc.) Fortunately, in the past, the wisdom of maintaining a loosely coupled adaptive system at the academic level finally bubbles up to the leadership of the institution, and academic units are set free once again. An example here was when Harold Shapiro set Engineering and Business Administration free to develop networks of powerful workstations as the alternative to the MTS-Amdahl time-sharing system. One of the results was CAEN, which rapidly evolved beyond MIT's Athena and CMU's Andrew systems to achieve leadership.

To be sure, ITS has important responsibilities that require mission critical computing, and it has been successful in keeping the trains running on time. But it is at the level of academic units rather than the enterprise level where innovation and leadership must occur. Why? Because they are driven by learning and discovery, by experimentation, by tolerance for failure, and by extraordinarily talented faculty, students, and particularly, staff. While perhaps a Beowulf in every closet is not very efficient, it has made MIT, Carnegie Mellon, and Stanford leaders, as well as Michigan with CAEN and MERIT (i.e., NSFnet and then the Internet).

So why this history? Because in reading through the current draft, I fear it sounds more like WangNet than the Internet. For example, consider the process of "rationalization" in IT services. Such a coordinated approach at the enterprise level has been quite effective in cost reductions in the corporate world. (As a director of Unisys, I am well aware of this approach.) However, one must take great care in applying such a process to the culture of academic institutions, where the adaptation to change is always bottom up and never top down. For some reason, the academic units today are under the impression that as the rationalization juggernaut moves ahead, it will attempt to pluck out the top talent in their units and attempt to relocate it to the enterprise level to staff ITS "shared services". Were this to occur, it would be both absolute disaster to the academic units and seriously undermine the confidence of faculty and staff in the role played by ITS itself. The spirit of "rationalization" that may work quite well in some areas of management could turn into a disaster if it pulls our best people away from the academic units where the real innovation is driven by the interests of faculty and students working closely with outstanding staff with extraordinary skills.

Last October at our NSF sponsored conference on the role of cyberinfrastructure in discovery and learning, many participants stressed the importance of "craft", of the contributions of truly talented staff who drive innovation in units where they are most competent. The list of such people at Michigan is very long, e.g., during my years people like Eric Aupperle, Randy Frank, Joseph Hardin, Paul Killey, and many, many others. These people are attracted to Michigan to work in academic units with faculty

and students where they are highly valued and have the freedom to do exciting work. Attempting to pluck them out and place them in more central roles will simply chase them off, seriously damaging the academic units and their primary missions of teaching and research in the process. This would be a disaster with very serious long-term consequences for the University.

Another general concern: One must be very careful in the tone of a document like this, since using the wrong language can set off alarms to the academic community and create resistance that will doom the effort. Perhaps it would be wise to get a small group of faculty (decidedly not academic administrators) to redraft this in more academic rather than administrative language.

More Specific Reactions (as I read through the drafts):

Principles that drive the direction of technology

Support the university mission? What mission? Of the University writ large? Of the academic units? Of generic language like teaching, research, and service...or discovery, learning, and engagement...or "Change the world!"...or what?

I am still very uneasy about "cloud first" strategies since it makes us far too dependent on carriers. Our people work all the time...and everywhere...on campus...at home...in airports...on planes...etc. Clouds don't work (yet) in many of these places.

Use IT governance structure to determine enterprise, commodity services? The IT Council? Surveys? In a loosely coupled adaptive system, you may need a more evolutionary system to do this, one that taps bottom-up rather than top-down perspectives. (Look at the number of faculty in medicine who bring Macs to meetings when their Medical Center "employer" demands Windows machines as commodities...)

Chose solutions that are easily created and replaced? Agility to be sure. But what about resilience? And maturity? (And, the charming phrase "optimum redundancy" coined by Martin at our recent meeting.) For example, while we have committed at the enterprise level to Google, this is a company that still has not grown up yet. We need to be careful about becoming overly dependent on adolescents (at least it so appears from my visit to the GooglePlex). This can lead to disaster. At least Microsoft is grown up...as are their software products, compared to Google "drive"....)

Scope of individual services

Certainly provide assistance to users, but just who are the "users"? Students? Faculty? Staff? Administrators?

The use of vignettes is likely to be misleading (remember the Vision 2010 exercise of the late 1990s). Again, the world is changing so fast that the most realistic projects will sound like science fiction. (Recall Bell Labs motto from the 1980s: "Fiber to the Forehead!")

Teaching, Learning, and Knowledge

I found this section very weak and unconvincing. Lots of buzzwords here. Blended education, experiential, personalized learning,... Actually, all of this stuff has been part of the university's portfolio since the 19th century! Even the massive markets enabled by MOOCs is not really new. UM TV was teaching courses for credit with over 100,000 students through live TV in the early 1950s.

Enterprise capabilities

Is integration realistic in a rapidly changing environment when unexpected technologies burst forth to disrupt the most carefully thought-out systems? “Adaptive” is probably the better goal.

On-campus vs. Off-campus vs. Everywhere, all the time: Most of the IT Strategic Plan is aimed at providing a cyberinfrastructure environment on campus. But the anyplace-anytime character of today’s world leaves hanging the majority of the time spent working by our students, faculty, and staff, which is off campus in their homes, dorms, cars, wherever. Without a major plan for high-speed connectivity throughout the community, this is a very incomplete strategy.

Portfolios and such: Here I really do worry about attempting too much to standardize the cyber experience. The university in general—and Michigan in particular—is one of the most intellectual diverse organizations in the world. In fact, its great strength and contribution to society arises from this very unusual diversity in ideas, experiences, and people. Again, this argues for a much more organic plan, essentially a diverse ecosystem that will continue to mutate and evolve in ways that we cannot anticipate.

As an example, the learning paradigm varies enormously across campus, from the general education of young students to disciplinary concentrations (compare deconstructing a poem with proving a theorem in algebraic topology) to professional education (operating on a patient or arguing a case before a court or building and testing a drone design). Too much of this is focused on undergraduate education as if we were primarily a “college”. We’re not. We’re one of the world’s great “universities”, and that is quite a different intellectual entity. Again, “seamless learning”, “emerging learning modalities”, etc., are not only buzz words but sound more appropriate for young K-12 learners than for the *Universitas Magistrorum et Scholarium* that characterizes one of the world’s great research universities.

Where is the subject of institutional collaboration? Fortunately, CIC has anticipated this in its approach to online learning. But beyond that, today our faculty work more with colleagues on the other side of the globe than across the hall; our students bring multi-institution study groups with them from their high school days...and Facebook, of course...most of our faculty are nomadic, moving from institution to institution every few years, just as our students will move on to other endeavors and institutions when they finish their studies. Again, more consideration needs to be given of life beyond the campus...and with institutions beyond our own.

Providing commodity services centrally or via the cloud. Again, here I worry that overdependence on commodity products, particularly to the degree we constrain the cyber environments of academic units through policies such as purchasing and shared services, will harm the loosely coupled adaptive culture of the university that is one of our greatest strengths. This is particularly

dangerous if we become overly dependent on particular vendors because of top-down rather than bottom-up forces. The reality is (and always has been) that it has been our faculty, staff, and students who spot the next big trends in technology and then drive change upward through the institution. (Here my own experiences involved teaching one of the universities first courses using microcomputers, then using Visicalc to run circles around the provost and VPCFO in budget analysis, then working with Dan Atkins and Dick Phillips to build CAEN, ...and the list goes on. Although top-down forces usually attempted to block this, fortunately, the University had visionary enough leadership in the 1980s to encourage this decentralized approach.)

Strategic Initiatives (or expensive boondoggles)

Here I have lots of problems, since I worry about massive investments in centrally-provided technologies that we will find obsolete within a few years.

For example, I do worry about the cost of some of the more popular (but probably superficial) infrastructure we are proposing to support learning. For example, video-capture of routine lectures is really quite silly. These are usually not of sufficient quality. And the primary reason students want them is so they don't have to attend class. Furthermore, in a research university, most faculty are at the cutting edge and continually tinkering with their classrooms to track the rapid evolution of knowledge in their field. A video of last year's lecture is already obsolete...and a video of last week's lecture probably has mistakes in it that the faculty member would just as soon forget.

It is far better to fully embrace MIT's OpenCourseWare approach, where the digital assets for the courses (rather than the lectures themselves) are provided to students to use in study groups.

Put another way, we should forget about building our own Netflix and instead let our students build MineCraft structures for themselves. We should stress content creation, not content consumption.

By the way, this is why tablet computers don't seem to be replacing cellphones and laptops on college campuses. iPads are great for consuming content but lousy at creating it. But then so are mobile phones. At a university, we want our students to learn how to CREATE content (papers, software, whatever), and this requires laptop or workstation technology.

Most of the strategic investments associated with the NextGen infrastructure seem to be focused on-campus...WiFi networks, high capacity networks in data centers, labs, etc., use of clouds. But most of the time our people (faculty, students, staff) will be tethered to our resources through 4 MB / s cable or telcom carriers. Hence, without robust connectivity beyond the campus, these major investments will fall far short of our needs. (Perhaps we should just hang a big Google "cloud" WiFi balloon over Ann Arbor and tell Comcast and AT&T to go to hell...)

(By the way, a couple of weeks ago I had to give a paper concerning the impact of IT on discovery and learning at the Davos-like meeting in Switzerland I help organize every two years for university presidents from around the world. I've attached a draft of the paper that makes several of the points in this memo.)

A handwritten signature in black ink, appearing to read "James J. Duderstadt".

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