Office of the Vice President for IT and CIO at Indiana University

CYBERINFRASTRUCTURE VALUE ASSESSMENT REPORT

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Office of the Vice President for IT and CIO at Indiana University
Cyberinfrastructure Value Assessment Report

EXECUTIVE SUMMARY

BACKGROUND AND CONTEXT

In September 2014, the Indiana University (IU) Office of the Vice President for IT and CIO (OVPIT) requested an independent value assessment of IU's cyberinfrastructure (CI) from the perspective of current and former IU faculty. This report includes the detailed findings of the assessment and provides recommendations for improving the value of IU's services to faculty.

FINDINGS

➢ **Compute Resources:** IU's high quality hardware, visualization, and compute storage resources are easily accessible to faculty and essential to their work.

➢ **Support Staff:** Faculty view research support staff as equal in importance to compute resources and believe more should be invested in expanding the number of expert staff.

➢ **Funding Model:** Indiana's approach to supporting core infrastructure is efficient, encourages discovery, and gives faculty a competitive edge when applying for external funds.

➢ **Education and Training:** Faculty rely on IU's education resources for their teaching and training workshops to prepare students and research staff. The expert support provided by UITS staff ensures courses and events run smoothly.

➢ **Disciplinary Commonalities:** Disciplinary commonalities include the need for maintaining a web presence in the biological/life sciences, importance of outreach to the fine and applied arts communities, and adherence to patient data policies in the health professions and related sciences.

RECOMMENDATIONS

❖ **Compute Resources:** Maintain the caliber of compute resources available at IU in order to support faculty research and sustain institutional competitiveness.

❖ **Support Staff:** Consider expanding the number of expert domain research support staff available. Recommendations for specific domains/specialists could be obtained during requirements gathering from current and potential users.

❖ **Funding Model:** Continue to fund sophisticated core infrastructure to sustain institutional competitiveness for external funds, promote access to resources, and foster discovery by both existing and new users of advanced computing at IU.

❖ **Education and Training:** Keep offering existing workshops and supporting faculty-led domain workshops to promote quick knowledge dissemination. Consider increasing summer

workshop offerings so that students can take advantage of events without extended commitment such as with formal courses.

❖ **Disciplinary Commonalities:** Expand support to include web presence and portals particularly for Biological/Life sciences faculty. Continue to provide outreach to new communities, especially Fine and Applied Arts communities. Also consider exploring feasible ways to implement policies for domestic and international patient data on IU systems.

Office of the Vice President for IT and CIO at Indiana University
Cyberinfrastructure Value Assessment Report

BACKGROUND AND CONTEXT

Information Technology at Indiana University (IT@IU) is comprised of two units, University Information Technology Services (UITS) and the Pervasive Technology Institute (PTI), working together to "create and maintain a constantly evolving IT environment to support Indiana University's vision of excellence in research, teaching, outreach, and lifelong learning." Services provided include support (i.e., phone calls, emails, etc.), supercomputing resources (i.e., supercomputers, research staff, etc.), and networks (i.e., fiber, and contracted networks). These services help IT@IU "translate research into action" by "helping Indiana's scientists solve challenges both big and small." OVPIT oversees IT@IU's activities and implements initiatives to enhance teaching, learning, research, and development at Indiana University through its six divisions and over 30 division units.

In September 2014, OVPIT requested an independent value assessment of IU's cyberinfrastructure (CI) from the perspective of current and former IU faculty. Following proposal approval, the evaluation team secured Institutional Review Board (IRB) approval from the University of Illinois at Urbana-Champaign for the study. This report includes the detailed findings of the assessment and provides recommendations for improving the value of IU's services to faculty.

Data Source

Interviews
Current and former IU faculty users of cyberinfrastructure services were asked to participate in semi-structured interviews regarding the value of IU's CI. A total of 23 faculty interviews were conducted with representatives from a variety of disciplines. Interviews lasted approximately 20–40 minutes, during which participants were asked about the value of IU's CI to their work. Specifically, interview questions regarded IU's (1) hardware resources and access, (2) compute storage and visualization, (3) integration of research tools into education, and (4) unique disciplinary opportunities or challenges. See Appendix B for the interview protocol. The method of data collection received IRB approval (see Appendix A).

Study Participants

Study participants included 23 current and former IU faculty from a variety of disciplines. Interviewees comprised two non-tenure track staff, 4 junior faculty, 12 tenured faculty, three retired, and two former IU faculty. Criteria for "former/retired" faculty include retirement from IU or transfer to another institution/organization. Seven participants have been at IU for less than five years and were considered "new faculty," while 11 have worked at IU for more than five years. Faculty research fell within the following five general disciplines: (1) Biological/Life Sciences, (2) Health Professions & Related Sciences, (3) Physical Sciences, (4) Fine & Applied Arts, and (5) Computer Science and Informatics. Participant fields of study were grouped based on the IDEA Education discipline/department codes (http://ideaedu.org/DisciplineCodes).

Figure 1. Participant Demographics: Tenure Status & Time at IU, N=23
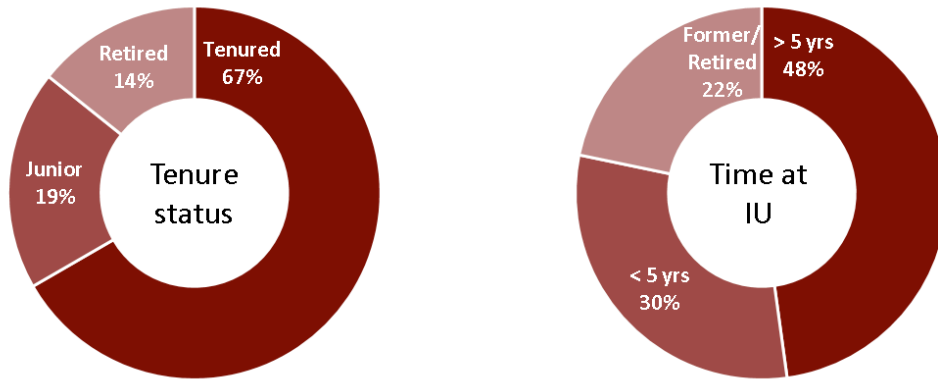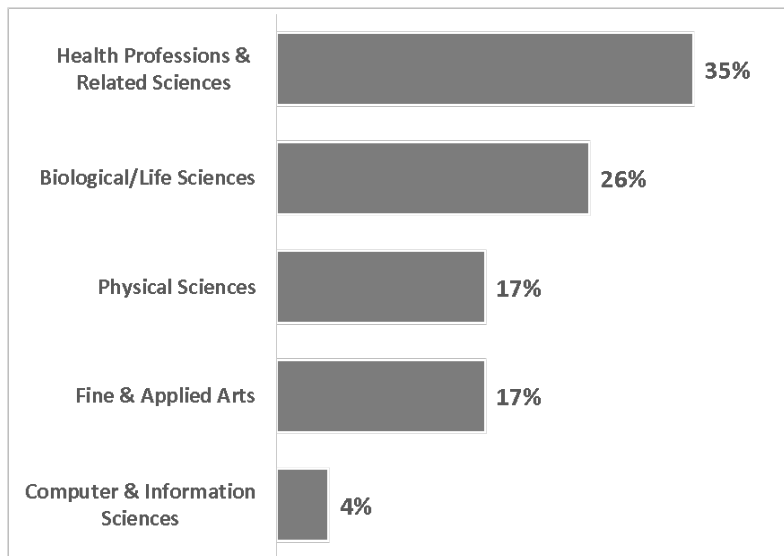

Figure 2. Participant Disciplines, N=23

FINDINGS

During data analysis the following findings emerged. Findings are grouped by relevant theme. Themes include (1) compute resources, (2) support staff, (3) funding models, (4) education & training, and (5) disciplinary commonalities.

Compute Resources

➢ **IU's high quality hardware, visualization, and compute storage resources are easily accessible to faculty and essential to their work.**

Hardware and Access

Faculty across disciplines hail the caliber of IU's hardware resources and its positive impact on the quality of research throughout the institution. Access and availability of these resources is also perceived positively, and junior faculty in particular consider these significant incentives for

joining IU. Some former faculty (retired or transferred) report maintaining access to some of IU's resources as a significant benefit as well. Some comments include:

– *"The day I left IU I had marvelous lab facilities and a lovely office with a beautiful view, I had been there for [number] years and the thing I was most sad about was leaving the UITS environment. That probably says quite a lot about the quality." – Former Faculty*

– *"If the caliber of the machines plateaued, we wouldn't be a very competitive university…" – Staff*

– *"I interviewed at several universities…some of the other universities which were top rated were a little bit underwhelming in terms of resources." – Junior Faculty*

– *"I continue to use the resources that I've gloriously been given access to." – Former Faculty*

Visualization
The visualization services, specifically the Advanced Visualization Lab (AVL) at UITS, were cited as a key resource for faculty both in their research and teaching. AVL's availability and quick response to individual faculty needs--from research laboratory setups to the creation of educational laboratory environments--were highly valued. In one case, AVL's solution nearly replaced the need for a physical lab setup for one faculty member. AVL staff were described as very supportive, responsive, and genuine. Some comments include:

– *"[During initial lab setup] the people at AVL were very helpful and came out to the lab to set things up and loaned us equipment." – Junior Faculty*

– *"Used AVL to develop a simple interface for students to use during a required course…this almost replaced the physical…lab." – Former Faculty*

– *"… within 24 hours having not spoken to them in a couple of years there was a responsive and they were supportive and 'yes we can help you with that' and 'by the way there's a new team that does this' and you know…they've been a complete gift to me and have really broadened my exposure to colleagues in other disciplines throughout the campus." – Former Faculty*

Compute Storage
When asked about compute storage at IU, faculty report access to sufficient amounts of storage for their work and the ability to obtain additional storage if needed. Others, such as those in the physical sciences, heavily rely on the Scholarly Data Archive (SDA) for their research. The SDA is particularly useful for archiving student data post-graduation or involvement in a research group, providing long-term access for future researchers and students. Faculty who have transferred to other universities miss the storage they once had at IU and report occasionally struggling to address the issue of storage during grant submissions. Some comments include:

– *"You get lots of storage without even asking. Not permanent but you can get more. Sometimes I wish we could keep our data in the temporary storage." – Tenured Faculty*

- *"Really depend on their scholarly data archive and students put their stuff in it. When students leave they put all their information in it." – Tenured Faculty*

- *"It does become a worry or bottleneck when you're writing your grant and when you carry out research, 'how are you going to store this data?'" – Former Faculty*

Policies

Some faculty that have used popular resources at IU report experiencing long queues. During significant deadlines, like grant submissions, however, these same faculty report benefitting from a "grant submissions queue" to facilitate meeting their deadlines. This policy is highly valued by faculty. Some worry others may abuse this privilege since it is based on the honesty of those concerned, but ultimately conclude that the benefits of completin their own work in time for grant submission significantly outweighs the small risk of abuse. Some comments include:

- *"To be honest with you, sometimes these things [queues] get really bad, when we get into grant submission deadlines they do open a special queue for us…I had the chance to enjoy that which is really really nice. So in terms of policy and how they support us, I honestly can't complain much." – Former Faculty*

- *"I hope people are not abusing it because there's no way you can verify it but you really have to take it in good faith…but my experience at that time was pretty good…they do try their best to set aside my request." – Former Faculty*

Support Staff

➢ **Faculty view research support staff as equal in importance to compute resources and believe more should be invested in expanding the number of expert staff.**

Availability

Faculty describe support staff at UITS and PTI as engaging, dedicated, and responsive, however, some feel more research support staff are needed. The current research support staff seem overburdened with their responsibilities according to faculty. One interviewee believes the research staff's perceived transience and overburdened status is due to an unclear career path resulting in a smaller number of staff. In terms of disciplinary commonalities, faculty in the biological/life sciences and health professions & related sciences reported a lack of available domain expert consultants. Some comments include:

- *"All the people I worked with at the Advanced Visualization Lab really stick with you until you could swim and they were always there if you had a question…it wasn't like ok who's next, they stuck with you." – Former Faculty*

- *"They don't have enough people who are full time dedicated in supporting research fields. Many of my colleagues gave up…that's not what I want…Missed [month] deadline for grants...Was working with someone who looked stressed and he suddenly left the group and gave the research over to another group at the center." – Junior Faculty*

- *"If that [the caliber of the machines] plateaued we wouldn't be a very competitive university…but people are the most important. Probably not a clear career path for them which reduces sustainability." – Junior Faculty*

Onboarding

Initial onboarding and interactions with UITS varied for interviewees; still most recount their experience as nebulous and inefficient. During the iterative process of relaying needs, some groups found it necessary to consult regularly with high-level UITS staff, which significantly slowed down the onboarding process. One new tenured faculty member recommended hiring a high-level consultant to gather requirements from specific units or centers and line up resource matching prior to interacting with research support staff. Some comments include:

- *"They speak a different language than you do…but slowly we found a common ground where I could share my goals…iteratively we would find solutions." – Former Faculty*

- *"Need to streamline how users interface with UITS because we lost time." – Junior Faculty*

- *"We need some really high level consulting and interface where we could share our needs and UITS could plan. In some ways the UITS infrastructure doesn't match our needs because we need high level stuff. The [lab resource] is a good example…maybe we don't need [to buy] it but maybe we need help solving the problem by using what's available. " –Tenured Faculty*

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Funding Model

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➢ **Indiana's approach to supporting core infrastructure is efficient, encourages discovery, and gives faculty a competitive edge when applying for external funds.**

Efficiency

Interviewees with computing experience outside of IU describe other campus funding models and reliance on external funds as inefficient. They report faculty frequently purchasing individual systems which they then have to maintain and service. Resources are not typically leveraged between researchers, so machines remain completely idle when not in use by the owner. Startup packages or external funds used to purchase systems generally do not include maintenance or renovation costs, resulting in piles of outdated equipment. In contrast, IU's shared approach is seen as extremely efficient and highly valued by all current and former faculty interviewees.

- *"There are places you have to apply to get funds to buy the cluster and then you have to manage the cluster and so it's a lot of time going into applying for infrastructure and then managing it which of course is a bit of a distraction from the actual scientific aspect of the work which is what we would like to focus on." – Junior Faculty*

- *"Here we have a lot of people who have or run their own servers and have them run unmanaged but in some ways that's a horribly inefficient model for computing, to have everybody and their dog have a system with a few cores and then try to*

individually manage those systems…it's very inefficient because of course what it means is when those servers are idle they're just completely idle they're not shared in any way so there's no leveraging and of course the infrastructure gets old and there's no opportunity to replace it. Let's be honest when we go to a university they give us startup funds they don't give us funds every year subsequently to renovate our systems. So I think that having something centralized that you have many users on and is updated I would think it's more efficient." – Former Faculty

- *"[When buying a blade for UITS to maintain] …the tradeoff there is that when I'm not using my full capacity they can then add that back to their general pool, so it increases their resources as well. But ya it seemed like a really incredibly awesome opportunity because otherwise…15 years ago I maintained a server and the technology is now well past what I know and I'd rather not have to learn it all myself again." – Junior Faculty*

Enabling Discovery

The funding model for Indiana's CI has created a space for faculty to openly enter and engage with high performance computing (HPC) by eliminating significant barriers such as maintenance responsibilities and short-term fee-for-service support. Faculty are able to "think bigger" due to a lack of significant obstacles to conducting new and innovative research. While other universities rely primarily on federal funding to support their faculty's computing needs, IU has taken a more active role in supporting all types of work-big and small. New and nontraditional users particularly benefit from this approach and are able to generate proofs of principle for future external funding competitions that otherwise would have cost significantly more time, effort, and funds via other means. Some comments include:

- *"I love being at [University] …but I think that's missing… let's try something that's never been done…because it's a fee for service…how are you going to pay…it makes you think smaller…colleagues here are much less willing to engage in HPC…what if I try this and this fails, I have to pay for it and I don't have the money or resources for that now…but at IU I could at least try things." – Former Faculty*

- *"Since I've come to [University] and talked to the VCR, "why is HPC different from the library or having lab space you see those as fundamental to the core mission or research and teaching? In some ways in this era of big data I see HPC as being in that same category as enabling or facilitating…his response to me was if it's a good enough idea you'll get it funded federally and then you can use the resources but so much of what I do I think requires proof of principle in the proposal…I haven't found him to be very open to that idea of core infrastructure…as someone who doesn't come from a computing background I've benefitted enormously from having a more open door policy at IU." - Former Faculty*

External Funding

Indiana's resources are regularly reported as a strength for grant submissions and funding requests. The caliber of the resources and lack of faculty maintenance responsibility allows funding to extend further in supporting their work. Faculty generally do not need to turn to other computing centers or apply for additional funds for resources such as small clusters or storage.

Interviewees describe this as a luxury and are grateful for an additional advantage during funding competitions. Some comments include:

– *"I don't need to go [apply for funds] for computational resources…if anything it's a strength that we have when we submit proposals for funds… I do not need to apply for either funds to purchase computers to carry out our intensive computational research, or for funds to purchase small clusters or time on other computers…as far as I am concerned I have everything I need through our infrastructure…I realize that I am very lucky." – Junior Faculty*

– *"I'm submitting a grant in [month] where I'm strongly alluding to the computing resources here…this is absolutely a strength…part of the grant is for money to buy a blade and the fact that I don't have to maintain it is a huge plus." – Junior Faculty*

Education and Training

> **Faculty rely on IU IT training resources to prepare students and research staff. The expert support provided by UITS staff ensures courses and events run smoothly.**

Education
Faculty report incorporating tools into their classrooms in a variety of ways. Some have students submit jobs on UITS compute resources, while others use live data feeds to engage students in lecture content. AVL's "play tools" were used by one faculty member to give students the experience of using computational resources. As previously mentioned, AVL's services nearly replaced the need for a physical lab space for one professor. Another interviewee plans to take advantage of IUanyWare so students have on-demand access to IU-licensed software applications required for course assignments throughout the semester. Incorporation of these tools leads to increased student engagement and understanding, according to faculty. Interviewees expressed no concerns about support for using the aforementioned resources and tools during courses. One faculty member stated that UITS staff will consult with students when problems with workflows arise during assignments. Some comments include:

– *"Sad to leave IU because…used immediate [organization] data feed during courses and it was very engaging with the students…one student came to me to do a research project with this data. [Organization] does not make this data public so the student could do a better research project and later published in a journal. At that time IU was one of only 10 places that was pulling down the feed and pushing into a database…it made teaching a much more engaging process and I think that's really critical…other colleagues used it too so it propagated to other classes." – Former Faculty*

– *"Sometimes we find what they [students] launch is nonsense, there's a gap between submitting a job and an intelligent job, sometimes the code is inefficient…when students have problems with workflow they will consult UITS which works well." – Tenured Faculty*

Training

Workshops are seen as a targeted means of training a small group on a specific concept, and those who have attended find them to be of good quality. Some faculty, however, would like to see current offerings expanded to teach users "how to use these infrastructures intelligently." This would be particularly beneficial for students who do not have the time to take a formal course but whose research requires use of the advanced systems. Most interviewees do not send their students to workshops, primarily because topics are unrelated to their work. To address this gap, a few have offered their own workshops with domain specific topics. These are done in conjunction with UITS staff, and faculty report significant success. Some comments include:

– *"Some people are fairly careless because there's little training on how to use these infrastructures intelligently. Training needs to be expanded. Need workshops, classes are good but workshops fit better." – Tenured Faculty*

– *"Many students take advantage of workshops for two to three days in summer when they don't have time to take formal courses." – Tenured Faculty*

– *"Did an outreach workshop because many collaborators needed similar help, staff was very supportive and hosted and even gave a tour of the data center etc." – Non Tenured Faculty*

Disciplinary Commonalities

➢ **Some disciplinary commonalities were identified including the need for maintaining a web presence in the biological/life sciences, importance of outreach to the fine and applied arts communities, and adherence to patient data policies in the health professions and related sciences.**

Biological/Life Sciences: Web presence
Interviewees in the Biological/Life Sciences expressed a need for increased support in creating web portals and maintaining websites. Regarding web portals, faculty are interested in learning how to build and maintain them for lab use. Those interested in websites would like services related to website hosting and maintenance. Faculty in the Biological/Life Sciences see this as an increasing need when competing for funding and future collaborations. Some comments include:

– *"In terms of personnel need expertise in web portals not the computational aspect but more on how to build these portals…this is the part where I've had to invest on my own and hire others to complete this work." – Tenured Faculty in Biological/Life Sciences*

– *"Web servicing towards hosting and maintaining websites. Increasing need, it's more and more important" – Non Tenured Faculty in Biological/Life Sciences*

Fine and Applied Arts: Outreach and Service
Outreach to new communities, particularly the Arts community, is highly valued by faculty in Fine and Applied Arts. Valued services include hosting workshops and providing individual project consultation. Faculty view outreach and services within the Arts as effective for reducing barriers to adoption by allowing artists to experience computing in a non-threatening environment. Compared to traditional HPC user, postdocs' and students' lack of computing knowledge forces them to rely more on this support. IU's funding model also grants artists

increased freedom to engage with advanced computing by reducing the risk of draining their comparatively small funding. Some comments include:

– *"Outreach event with [underrepresented students] where [participants] made [products] and put together business plans…very successful at getting [participants] interested in computing…" – Tenured Faculty in Fine and Applied Arts*

– *"I want to emphasize the arts sector, a lot of sciences have postdocs and students to figure stuff out for them and we really need that simple interface…" – Former Faculty in Fine and Applied Arts*

– *"I would hate to see the lifelines cut from the outreach programs and service programs in the arts." – Former Faculty in Fine and Applied Arts*

Health Profession and Related Sciences: Patient Data Policies
Due to the nature of their work, many faculty in health professions and related sciences often deal with sensitive patient data. Interviewees report independently storing their data in order to meet strict policies for protection of patient confidentiality. One faculty member believes IU is currently working to become aligned with HIPAA (Health Insurance Portability and Accountability Act of 1996, Pub. L. 104-191) regulations, however, this may not be sufficient for those who obtain data from patients outside of the US. Varying policies restrict external resource suitability and burden faculty considering scaling their future work beyond their lab's current computing capacity. Some comments include:

– *"We deal almost explicitly with identified patient data. If the system gets compromised, there are many penalties so universities are hesitant…people at IU are not as apprehensive and the university is working on getting HIPAA aligned." – Tenured Faculty in Health Professions and Related Sciences*

– *"When collecting patient data that I am going to have to store myself that's not connected to the internet…some of the data is from another country and policies would have to appease that country." - Junior Faculty in Health Professions and Related Sciences*

RECOMMENDATIONS

❖ **Compute Resources:** Maintain the caliber of compute resources available at IU in order to support faculty research and sustain institutional competitiveness.

❖ **Support Staff:** Consider expanding the number of expert domain research support staff available. Recommendations for specific domains/specialists could be obtained during requirements gathering from current and potential users.

❖ **Funding Model:** Continue to fund sophisticated core infrastructure to sustain institutional competitiveness for external funds, promote access to resources, and foster discovery by both existing and new users of advanced computing at IU.

❖ **Education and Training:** Keep offering existing workshops and supporting faculty-led domain workshops to promote quick knowledge dissemination. Consider increasing summer workshop offerings so that students can take advantage of workshop series.

❖ **Disciplinary Commonalities:** Expand support to include web presence and portals, particularly for Biological/Life sciences faculty. Continue to provide outreach to new communities, especially to the Fine and Applied Arts communities. Also consider exploring feasible ways to implement policies for domestic and international patient on IU systems.