

Conversations with University of Washington Research Leaders: Final Report

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EXECUTIVE SUMMARY

Conversations with University of Washington Research Leaders represents a large-scale effort to assess the information technology (IT) needs of the University of Washington's (UW's) top researchers. A joint effort of UW Technology and the eScience Institute, the goals of the project were (1) to understand how UW researchers currently use technology and anticipate using technology in the future to support their research activities, and (2) to identify the resources and services they need to maintain and build upon their remarkable record of success. To accomplish these goals we interviewed 127 researchers.

Key Findings

UW's researchers are pursuing their work in an increasingly competitive funding environment, and many report spending greater time seeking grants and other funding sources. Another trend is an increasing focus on interdisciplinary and inter-institutional projects. In terms of IT, UW researchers assume and rely upon advanced network connectivity already provided by the UW. They also commonly leverage external resources, including IT support or infrastructure provided by research partners and other external entities.

The IT needs of UW researchers fall into six specific clusters. First, researchers indicated a need for more local IT support and data management expertise. Many expressed needs related to data management infrastructure. Researchers reported needing significant amounts of on-demand or ongoing computing power. Others want access to real-time collaboration technologies and easy ways to work with colleagues outside the UW. There is a great need for additional human and computational resources to aid in data analysis and data collection. Finally, researchers are interested in sharing resources and want more information about what is available to them at UW.

Recommendations

To address any of these needs ***the UW must sustain its leadership in campus, metropolitan, regional, national, and global networking infrastructure.*** At the same time, the UW should provide, either directly or through "cloud-sourced" (third party) solutions, the following:

- (1) ***a new data management paradigm*** that integrates human know-how with the hardware, weaving data management, collection, and analysis expertise with data management infrastructure;
- (2) access to ***on-demand IT expertise and consulting*** across several domains, ranging from security to basic IT support;
- (3) ***greater availability of computing power***, be it sustained or on-demand;
- (4) basic ***enhancements to the communication and collaboration toolset*** to bring greater flexibility and availability; and
- (5) ***a "Research Commons"***, bringing together researchers, their support staff, and central units to share information and identify collaborative opportunities.

INTRODUCTION

The University of Washington (UW) has a long and proud tradition as a research leader. For the past three decades, the UW has been among the top recipients of federal research and training awards in the nation. In 2007, sponsored research at the UW totaled over \$1 billion and grant and contract awards funded nearly 6,800 full-time equivalent positions.ⁱ The UW recognizes, though, that past performance cannot guarantee future success. In an increasingly competitive research climate, institutions must make sound strategic decisions in order for research efforts to continue to thrive. Current, reliable information about the needs of researchers provides an essential foundation for making informed decisions about issues related to information technologies (IT) and technical support. Therefore, the UW has been engaged in a large-scale effort to assess the IT needs of its top researchers. The focus on IT needs stems from the recognition that technology influences all aspects of the research process—from collecting, storing, analyzing, and sharing data to communicating and collaborating with colleagues. Across disciplines, the advancement of knowledge is becoming increasingly dependent on technology.

Conversations with the University of Washington's Research Leaders represents a joint effort of UW Technology and the eScience Institute. The goals of the project were (1) to understand how UW researchers currently use technology and anticipate using technology in the future to support their research activities, and (2) to identify the resources and services they need to maintain and build upon their remarkable record of success. Over the course of this project, approximately 50 IT professionals from UW Technology and other units met with more than 100 researchers to learn firsthand about current research projects and the pivotal role that technology plays in supporting these efforts. The influence of these interactions cannot be overstated—through this project UW Technology and the eScience Institute have increased our general awareness of researchers' experiences and needs. The *Conversations* project is unique in its scale and focus: none of the UW's peer institutions has attempted a similar level of outreach to the research community.

This report marks an important step towards accomplishing the project's final goal, identifying resources and services that UW Technology and the eScience Institute can offer to support researchers. In this report we describe the general research climate at the UW and then outline six specific areas in which researchers have needs. We conclude our report with a series of recommended actions for the UW to take in order to meet researchers' evolving IT needs. While the findings and priorities that we describe are specific to the UW, we anticipate that researchers at other institutions may have similar needs; the model of needs assessment we employed and the discussion we provide in this report may also be of use to other institutions that wish to better understand their researchers' needs and priorities.

METHODS

The *Conversations* project began with a pilot study, from Spring 2007 to Spring 2008, in which senior IT professionals at the UW began to identify the IT needs of researchers and build relationships within the research community. In individual interviews, we asked researchers general questions about their current projects, the technologies they used in their work, and likely future directions of research in their field. From late Spring 2008 to Winter 2009, we conducted a formal assessment of researchers' IT

needs. These interviews involved a specific set of interview questions derived from common themes we identified in the pilot data. Questions focused on researchers' current research, future research, current technology use, and future technology needs.

During both phases of this project, two IT professionals met for up to one hour with each researcher. Some researchers chose to have additional members of their research team present during the interviews. Data from the pilot included both audio-recordings and interviewers' field notes. During the formal assessment, interviewers also entered summary information about each interview in an online database.

Participants

During the pilot study and the formal needs assessment we contacted a total of 290 of the UW's top researchers at various stages in their careers and working in a wide variety of disciplines. We selected researchers based on the number and monetary amount of grants received relative to others in similar disciplines, as well as prestigious recognition by career status (e.g., Sloan Research Fellowships, Packard Fellowships, and NSF CAREER Awards for junior faculty; National Academies membership for senior faculty). We also contacted researchers who were recommended by their peers.

- **Spring 2007 to Spring 2008:** We interviewed 37 researchers during the pilot study. In addition, one researcher emailed responses to the project team, for a total of 38 participants.
- **Summer 2008 and Winter 2009:** We interviewed 87 researchers during our formal needs assessment. In addition, two researchers emailed responses to the project team, for a total of 89 participants.
- **Total Response:** Of the 290 researchers originally contacted, 127 researchers participated in the *Conversations* project. Twenty-six researchers on our contact list retired or left the UW during the course of the project. Our response rate was 48%.

Analysis & Reporting

An analysis team, consisting of four researchers and user-experience experts from UW Technology, conducted a constant comparison analysis of needs assessment data (interview notes and summaries) to identify unique areas where researchers expressed IT needs. We developed a thorough and distinct list of codes for these needs. Examples of the codes used in our analysis include: data collection; data visualization, modeling, or simulation; public access to data; labs and equipment; and videoconferencing. After developing a list of codes, we reviewed and coded all interviews. We also noted whether these needs were currently unmet or if researchers had found an adequate solution for the problem they described. To identify the highest priority needs, we counted the number of instances of unmet needs in each category. To complement this tally of IT needs, we also incorporated detailed accounts from the interviews into our narrative descriptions of the trends we observed. Given the diversity of research projects conducted at the UW, a clear consensus on technology-related priorities and needs did not emerge among researchers. The findings in this report represent areas of

convergence where significant numbers of researchers across disciplines mentioned similar needs or where a subset of researchers voiced nearly identical needs.

FINDINGS

General Research Climate

In general, UW's researchers are pursuing their research in an increasingly competitive funding environment. Several of the researchers we interviewed mentioned the low percentage of grant applications funded annually by the National Institutes of Health (NIH) and other agencies. Although NIH was commonly cited, these observations transcended disciplinary boundaries. While many researchers expressed confidence in their ability to maintain funding levels in this environment, some acknowledged that doing so would require them to spend significantly more time applying for funds. Other researchers reported that they had sought or were considering seeking additional sources of funding (e.g., private donors, corporations, or government agencies) or a new scale of funding (e.g., funds to establish a program or center, rather than funds for individual projects). One researcher in Medicinal Chemistry described how he "bootstrapped" funding from multiple sources to conduct a small-scale genome study. However, he did not feel that this financial approach was sustainable over time; ideally, he would need a program or center grant from NIH to fund this type of endeavor adequately.

Another trend among researchers is an increasing focus on interdisciplinary and inter-institutional projects. This trend is driven both by the complexity of research questions being asked and by granting agencies' preference for funding translational and collaborative projects. A substantial majority of researchers indicated that they were reaching beyond traditional disciplinary boundaries to conduct their research. For many, these interdisciplinary partnerships were new and represented relationships they would have been unlikely to form in the past. For instance, a researcher in Microbiology, whose past work on plant diseases and genetic modification had been completely lab-based, is now investigating what happens to these plants in a natural environment. Understanding the complexities of soil composition, however, required collaboration with specialists in soil science; he has found partners in the UW College of Forest Resources. Nearly all researchers we interviewed indicated that they were collaborating extensively with researchers at other national universities and over one third specifically mentioned international partners. Additionally, many of these researchers are working closely with local and federal government agencies and industry partners.

While at first glance the above trends may appear unrelated to technology or technology support, they provide a valuable context in which to situate researchers' IT needs. For instance, any additional time researchers spend pursuing funding leaves less time for them to focus on IT issues or to conduct their research. In addition, researchers' inter-institutional partnerships directly influence their needs regarding data security and access, communication, and collaboration.

General IT Climate

The UW was an early leader in developing and growing advanced networking on campus, in the Seattle metropolitan area, across the state and region with projects like the K-20 Network and Pacific

Nothwest Gigapop, and nationally and internationally through efforts as diverse as Internet 2, National LambdaRail, CENIC, and Pacific Wave. From gathering data via remote sensors on the ocean floor, to downloading terabytes of data from NASA, to archiving and offering materials related to the Rwandan genocide, UW researchers rely upon high-performance networks to carry out their work. A researcher from Oceanography observed that many in the UW research community simply assume the connectivity, computational power, and public outreach infrastructure that the UW has built will consistently be available. In many respects, UW's leadership in networking infrastructure favorably positions UW researchers as they seek grants and other sources of funding.

The term "cloud-sourced" is often applied to externally hosted applications or infrastructure offered by companies such as Google, Microsoft, and Amazon and to a host of innovative productivity tools provided by smaller, focused companies. The engineering and system administration expertise these companies possess as well as their ability to innovate often far outpaces what any single university can do. Several UW researchers explicitly mentioned that they already use, or would like to use, cloud-sourced technologies from these third parties. What is clear is that almost all researchers rely upon someone outside their immediate work group, department, or unit to provide infrastructure, IT support, collaborative applications, and a host of other resources. In addition to the offerings of the third-party vendors mentioned above, use of infrastructure and applications provided by other universities, partners in industry, institutes, and even the government is pervasive.

IT Needs

The IT needs that follow are listed in order according to the frequency with which researchers reported needs in each area: (1) IT and data management expertise, (2) data management infrastructure, (3) computing power, (4) communication and collaboration tools, (5) data analysis and collection assistance, and (6) additional resources.

1. IT and Data Management Expertise

Interestingly, technology alone does not surface as researchers' primary need; rather researchers need *people* to provide IT support and expertise. Over one third of researchers reported a general need for local technology support, and approximately one quarter mentioned a specific need for expert assistance in designing and maintaining databases. Taken together, IT support and/or expertise needs were expressed by nearly half of researchers. Many researchers also desired expert advice about current and future technologies.

- **Local Technology Support:** The majority of researchers rely on departmental IT staff to support their research teams. Many of these researchers expressed a need for increased local technology support, whether at a departmental level or shared between research teams in close proximity. A few commented on needing support for Mac computers, since their departmental support focused on PCs. Many researchers had a graduate research assistant take on technology support, sometimes in place of their research work. One researcher shared a story that aptly illustrates the challenges of this support model: when his graduate research assistant could not find a driver for a

new printer, it was more cost effective to exchange the printer for a different model than to keep looking online for the solution.

- **Data Management Expertise:** Researchers asked for expert assistance in handling data management problems, ranging from configuring databases, to consolidating and restructuring large data sets, to ensuring secure storage and timely destruction of sensitive data. A few research teams lacked any expertise in this area and desired assistance with the initial task of envisioning a better data management system. Some problems were basic: one researcher sought to migrate data from individual researchers' computers, where data can be difficult to access if someone leaves the team, to a shared storage solution of some type; another was interested in upgrading from a system of storing data in 3-ring binders to a digital solution. Some researchers outsourced data management to for-profit companies such as DatStat™, because they could not find a UW service that met their needs.
- **Information:** A few researchers desired more information about the technologies and technological expertise currently offered by UW. Researchers wanted centralized access to this type of information. One researcher offered a vision of a service that would inform her of new technologies related to her work as they became available.

A common refrain among researchers was that they do not want to spend much time finding data management solutions or solving technology support problems—they would rather spend their time doing research. Many of these researchers wanted to consult with a database administrator, system administrator, or technology support person on an as-needed basis, rather than having to pay for a permanent staff member with these skills. Several envisioned a communal solution to these problems, where staff with appropriate expertise would be shared among research teams or departments, or where the UW offered a consulting service to meet these needs.

2. Data Management Infrastructure

Researchers in a variety of disciplines are collecting large, and often rapidly increasing, volumes of data. In many disciplines, researchers are collecting a vastly larger amount of data today than was possible to collect a decade prior, or, in some sciences, a month ago. Researchers in Fisheries, for example, have been collecting data on Alaska's salmon population since 1946. However, the amount and type of data they are able to collect today is significantly more complex, detailed, and voluminous than data collected in the early decades of the project. Similarly, a Psychiatry and Behavioral Sciences researcher reported that collecting data using eye-tracking software, rather than through detailed observational notes, resulted in an exponential increase in the amount of data collected in that field. Even more extreme, researchers in Genome Sciences reported that where they once ran 96 samples per DNA-sequencing machine, they can now run 10 to 20 million per machine. Researchers in Genome Sciences anticipate this number will increase by a power of two every few months over the next few years.

Given the large data sets described above, it is not surprising that well over a third of researchers face challenges involving various aspects of data management and the attendant infrastructure. The most common data infrastructure needs included access to sufficient storage, reliable backup systems, and adequate security.

- **Access to Storage Infrastructure:** Many researchers reported that they need assistance with data storage, whether storing large amounts of data for current research projects or archiving data from past projects for future access. Several researchers mentioned needing terabytes of storage space, while one researcher in Electrical Engineering asked for petabytes. Researchers' storage challenges not only involve access to sufficient storage capacity, but also access to adequate physical space to house servers for data storage. On a related note, researchers commented on insufficient power and air-conditioning in their facilities as barriers to housing servers.
- **Data Backup:** Among researchers, the systems used for backing up data were inconsistent. Several reported concerns about infrequent and inefficient backup practices, while a few reported prior problems with lost data. As IT professionals, some interviewers were concerned that several of the researchers they met with were using inadequate backup practices, such as storing data for a project on a laptop or flash drive. These practices were not always recognized as problematic by the researchers involved.
- **Data Security:** Security, especially in terms of access control, is a priority for many researchers since data collected in studies are often confidential, and access must be limited to the research team. The wide range of local, governmental, corporate, academic, and international partners with which researchers collaborate complicates the issue, since different institutions often rely on unique authentication systems and security protocols. UW researchers need secure options for granting their non-UW partners access to data and other research files.

Several researchers mentioned central data storage or central back-up services as potential solutions to meeting their needs in these areas. While many were open to cloud-sourced options, a few mentioned the high cost of data storage provided by for-profit companies as a reason they would like to see the UW offer a central storage option; these researchers felt that the UW could offer a similar service at lower cost. One suggested the Allen Institute for Brain Science (<http://alleninstitute.org>) as a model to follow in order to set up effective, centrally supported storage. Another researcher felt that UW's Genome Studies offered a good model; he and others valued the high degree of customization available for the servers and databases managed by that department. Several other researchers echoed the desire to find customized solutions that respond to their teams' specific workflows and data management infrastructure concerns.

3. Computing Power

Well over one quarter of the researchers we interviewed reported that their work involved computationally-intensive activities, and nearly all of these researchers stated specific needs related to managing or accessing high-performance computers or computer clusters. While some researchers' computing needs are met departmentally, others have to contract out for these services with other departments, institutions, or businesses. In addition to computing power, the importance of access to high-bandwidth networks was explicitly mentioned by several researchers.

- **Computing Power:** No matter where they fall on the spectrum of overall computing power use, many researchers require increasing levels of computing power for activities such as generating statistics, analyzing data, creating models and simulations, and general "data crunching." While

these researchers expected to have an ever-increasing need for more powerful machines, they cited lack of resources, space, and funding as limitations to acquiring more computing power. Some researchers expressed frustration at not being able to realize the full potential of their work due to these needs. For instance, a researcher in Bioengineering stated that his research team could do more with their data if they had more CPU power. A researcher in Fisheries explained that his analysis work is limited by how long it takes to run computations; if the computational process exceeds 24 hours, they tend to run those computations less frequently.

- **Managing and Housing Computing Clusters:** Alongside the need for more computing power, researchers described challenges in configuring, managing, and housing computing clusters ranging in size from 10 to 1000 nodes within their research groups or departments. Most notably, one researcher told interviewers about a donation of 100 cores from IBM, which sat in boxes for nine months because his department did not have adequate electrical power to run them. Similarly, a researcher in Statistics reported spending a significant amount of time trying to get air conditioning installed in various closets in his building so that he could house 10- to 12-node computer clusters. He found this process to be inefficient and wasteful.
- **Network Access:** Some researchers reported that the need for additional bandwidth is constant and will only gain in importance over time, although less than one fifth of researchers specifically mentioned “high-bandwidth” network access as a requirement for their research. A few researchers cited specific needs related to network access. These researchers said that lack of bandwidth negatively impacts data transmission and analysis, collaboration, and remote access.

Many researchers saw communal resources as the primary solution to their computational needs. Several researchers thought the UW could leverage its buying power and offer communal computing services or access to cloud-sourced services for less money than it would cost researchers to maintain their own computing clusters or to hire an outside service. These researchers indicated they would rather focus on their research and not worry about purchasing, housing, supporting, and securing servers. Many researchers already paid other departments, institutions, or businesses to meet computing power needs. Some also indicated that their computational needs tend to fluctuate over time, meaning they can often go for long periods of time without having a need. These hiatuses made researchers feel it was impractical for them to administer their own hardware; by the time they would need to use the equipment again, it would be outdated and underpowered. One researcher mentioned that he had looked at cloud-sourced services from Amazon and found that they might be useful if he needed a lot of computational processing done in a very short time. Another researcher in Biostatistics said he would like the UW to provide fast, secure access to terabytes of storage. He thought the UW could offer a suite of cluster-computing environments designed and configured to provide packages of computing cycles that would meet the needs of the majority of campus research groups.

4. Communication and Collaboration

More than one quarter of researchers, particularly those with extensive partnerships beyond UW, identified real-time collaboration technologies as critical to their work. In this area, however, there is substantial variance among researchers as to which technologies they use, or would like to use, to meet their distance collaboration needs. In addition, as researchers’ technology use becomes more

sophisticated (for instance, moving from teleconferencing to videoconferencing), their needs for financial or technical support also increase.

- **Videoconferencing Facilities:** Approximately one fifth of researchers expressed needs for better access to videoconferencing facilities or enhanced features for existing facilities, such as easier-to-use technology and improved document sharing. One researcher who had already used point-to-point videoconferencing with success desired multi-point videoconferencing; another desired high-definition videoconferencing. Several other researchers felt that current videoconferencing technology lacked sufficient reliability, ease-of-use, adoption levels, and local availability to be worth the effort. Some researchers anticipated using videoconferencing more in the future once these issues were resolved.
- **Web-conferencing Solutions:** Not all researchers with real-time collaboration needs desired to use videoconferencing facilities to meet those needs; several researchers found Web-conferencing solutions to be more effective. Solutions used by researchers ranged from Skype™, to Web-based videoconferencing, to desktop-sharing technologies (Web-based collaboration tools where participants can see others' desktops in real time). Some researchers expressed interest in using Web-conferencing solutions in the future, but needed more information about their options, as well as better access to desktop-sharing technologies. One such researcher reported wanting to perform complex computations in real time, rather than show models that were already created; others wanted to share documents and formulas. For some researchers, the cost of this technology can be prohibitive: a research team in Psychiatry and Behavioral Sciences reported paying \$20,000 for a year of access to software that allowed them to simultaneously chat, use a wiki, and share PowerPoint presentations. Other desktop-sharing technologies that a few researchers mentioned were WebEx™ and GoToMeeting™.
- **Teleconferencing:** For the Biostatistics department, advanced teleconferencing is essential, but expensive; researchers in that department reported spending \$50,000 to \$60,000 a year.

Additionally, despite the high-tech focus of our inquiry, researchers repeatedly discussed basic communication and collaboration technologies. Researchers often found it easiest to use generally available technologies when multiple institutions and organizations collaborate, since sophisticated technological solutions were not always available to all partners.

- **Phone and Email:** Most researchers identified telephone and email as "critical" technologies. These technologies are often the primary mode of communication and collaboration; over half of the researchers indicated that email and phone alone met most of their needs. Researchers use email for communication but also for writing papers; they and their collaborators email drafts back and forth to each other. A few researchers encountered problems emailing large attachments, due to email providers' limitations on file size.
- **Remote Desktop Access:** Several researchers expressed a need for remote desktop access. A few are already using this technology for access to software with limited licenses, high-powered computers, and the servers and configurations to which they are accustomed.

- **Wikis:** A couple of researchers mentioned successfully using wikis to collaborate with their teams; others had not yet tried wikis, but mentioned that they were interested in technologies that would allow them to post, edit, and share notes, or share the analysis and results of a study with their teams. Researchers also mentioned a need for access control.
- **Public Access:** Researchers reported sharing lectures, articles, and raw data with the public through Web sites, blogs, Slashdot, and UWTV. While there were not many needs expressed in this area, a few researchers mentioned that they could use help with blogs or Web site design and development and expressed the desire to acquire more skills with these technologies. One researcher pointed out the universal challenge of regularly maintaining a Web site and keeping materials up to date.

Some researchers desired ubiquitous, local videoconferencing options and felt that the UW should expand its videoconferencing facilities accordingly. However, the most common request researchers made of the UW in regards to communication and collaboration technologies was for more information about the communication technologies already available to them at the UW. Many of the researchers who currently rely exclusively on phone and email to meet their communication and collaboration needs were interested in using other technologies (from wikis to desktop-sharing technologies), but indicated that they would require better access to information about their options and easy-to-use technologies in order to change their current practices.

5. Data Analysis and Collection

As researchers' data management and infrastructure needs represent the necessity of integrating human know-how with the hardware to handle research data, so do their needs regarding data analysis and data collection. Nearly one quarter of researchers expressed a need for either data analysis expertise or for technologies to support data analysis through visualization, modeling, and simulation. A smaller group of researchers expressed similar needs regarding data collection.

- **Analysis:** As the amount of data collected increases, so do researchers' data analysis needs. Nearly all of the challenges researchers reported regarding analysis stemmed from the need to make sense of vast amounts of data. Here, researchers reported a need for specialized expertise—people with computational skills as well as familiarity with the research being conducted. One medical researcher reported that bioinformatics skills are a “must” in his field, but finding expertise in this area is a challenge. Another researcher in Immunology described a problem finding programmers able to write customized analytical software to address frequently changing analysis needs.
- **Visualization, Modeling, and Simulation:** Almost one fifth of researchers used visualization, modeling, or simulation to display and analyze their data. A smaller number of these researchers expressed the desire for additional resources to meet needs specific to their projects. While the use of visualization and modeling does not presently appear widespread among those we interviewed, these needs may grow in the future as the volume and complexity of data collected continue to increase.

- **Collection:** Overall, researchers are making efforts to streamline their data collection process. Many reported moving to electronic data collection exclusively. Most of the researchers we spoke with either already input and access data via the Web or are trying to establish these systems. Obstacles to creating online databases are both technology- and personnel-related; researchers reported difficulty finding people with the appropriate “know-how” to assist them. Researchers also desired greater flexibility and capacity for gathering data in the field. Mobile and remote devices are becoming increasingly important to researchers for this purpose. A few researchers who were currently using mobile devices reported that they wanted to do more with the technology (for instance, conduct simple analyses or collect and store more data).

Just as many researchers wanted to consult with a database administrator or a technology support person on an as-needed basis, many researchers wanted similar access to individuals with data analysis expertise. Several of these researchers envisioned the UW helping them to make connections across departments and research teams so they could easily locate people with these skills.

6. Additional Resources

In previous sections of this report we articulated researchers’ needs for a variety of communal services and resources, ranging from data storage services to computing clusters. In addition to those needs, several researchers expressed a desire for communal laboratories that would provide access to high-cost equipment. Researchers also reported needs related to educational technologies and centralized information to support research administration. A few researchers noted the value of leveraging the UW’s buying power to obtain discounts on software licenses or other purchases.

- **Labs and Equipment:** Nearly one fifth of researchers reported needs related to labs and equipment. Several researchers mentioned that as the cost of laboratory equipment increases so do their difficulties purchasing such equipment on individual grants. Several researchers observed that shared access to equipment and common facilities presented a potential solution to this problem. In approximately one fifth of the interviews, researchers reported they would like to use or were currently using communal labs and equipment to support their research. The National ESCA and Surface Analysis Center for Biomedical Problems and the Keck Microscopy Facility were two communal facilities at the UW that researchers pointed to as effective models. Specifically, researchers in several fields would like more access to analytical ultracentrifuges and equipment for single molecule spectroscopy and whole-genome analysis.
- **Educational Technology:** The link between research and education is strong, and researchers are continuing to look for innovative uses of technology to support learning among both students and colleagues, within and outside of the classroom. One quarter of researchers expressed needs in this area, particularly with technologies that would allow for visual presentation of, and interaction with, information, such as Smartboards, tablet PCs, online simulations and animations to illustrate complex concepts, clicker technology and streaming videos, blogs, wikis, and e-portfolios. For some, access was the issue: one researcher in Medicine wanted access to the slides and curricula of other faculty so he could build on his students’ education. Others advocated for student access to core modeling software such as MATLAB, and for broad access to videotaped campus seminars.

- **Centralized Information:** Approximately one fifth of researchers wanted access to centralized information. The types of information they desired ranged from a central database of research subjects that had been broadly-consented (and thus could potentially be used in other UW medical studies), to a center that would provide grant-writing information and support, to a database of projects that would make it easier to learn about other UW researchers and research projects.
- **Group Pricing:** A few researchers remarked on the importance of software licenses to their work and the significance of obtaining discounted rates on expensive products like ChemDraw™. On a similar note, a group of researchers wanted help in negotiating discounts with cell phone vendors.

Although the areas of need described above are disparate, all ask the UW to coordinate resources and information. Since many of the above needs extend beyond the IT focus of this project, additional investigation may be necessary.

RECOMMENDATIONS

We have a clear understanding of how researchers currently use technology to support their research activities, the networking infrastructure they rely upon, and the unmet and anticipated future needs. The alignment of needs across disciplines amongst our research leaders with regard to data management, on-demand expertise and consulting, computing power, communication and collaboration tools, and informational and organizational resources is unmistakable. With this solid foundation, the task of making sound, strategic recommendations that will allow the UW research enterprise to thrive is relatively easy.

We offer these recommendations to two different audiences, central institutional units and the UW research community. By central institutional units, we mean predominantly UW Technology, the eScience Institute, the Office of Research, and the Office of Information Management—all of which contribute greatly to supporting the University-wide technology fabric and the research community. As for the UW research community, we have in mind the researchers themselves and those who support them in their colleges, schools, departments, and programs, especially technology staff. Working together, these two groups can help the UW maintain and build upon its remarkable record of achievement in research.

Researchers depend heavily upon UW's leadership in networking infrastructure, and the UW must continue to sustain and advance these resources. The UW research community relies upon this infrastructure to be competitive and future innovations in advanced connections, private LAMBDA, and research and development networks will favorably preposition UW researchers as they seek funding and collaborators. Also, **the UW should also pursue cloud-sourced solutions whenever suitable.** By brokering and negotiating relationships to make using cloud-sourced solutions easy and cost-effective and providing expertise in using these solutions, the UW can leverage these solutions to greatly advantage UW researchers. To address the IT needs explicitly expressed by UW researchers, our recommendations for central institutional units are several:

(1) We need **a new data management paradigm that integrates human know-how with the hardware.** Researchers generate more data more often than ever before; simply housing it is not enough. Many researchers need assistance with data management, including data schema design,

database design, and parallel computing tasks, as well as with data analysis and data mining. This must be in place together with a range of secure data management infrastructure options. Researchers need access to reliable back-up services, long-term and dedicated as well as short-term cloud-sourced offerings, and high-availability data management infrastructure.

(2) There is a widespread demand for **on-demand IT expertise and consulting** across several domains. In addition to consulting with regard to data management, researchers need consulting and hands-on help with security issues as well as with the design and administration of networks, server clusters, and storage systems. Finally, end user support for common technologies and technology tasks is often lacking. We recommend that the UW provide “rent-an-expert” services to meet these needs.

(3) There must be **greater availability of computing power**, be it sustained or on-demand. Researchers require increasing levels of computing power regardless of where they fall on the spectrum of overall computing power use. Often related to their use of computing power is a need for high-performance network. We recommend that researchers have access to both sustained and dedicated computing infrastructure as well as pay-as-you-go on-demand access to computing power, whether it is hosted at the UW or in the computing cloud.

(4) A few basic **enhancements to the communication and collaboration toolset** would go a long way towards improving the way researchers work with their colleagues outside the UW community. First, we recommend greater availability of drop-in videoconferencing facilities and a more ubiquitous and supported Web-conferencing solution. Though most researchers are happy with the Web-based tools available to them, we must address the very real difficulties in collaborating with people and groups beyond UW. One means to do this is pursuing and providing guidance for using cloud-sourced solutions that simplify access. We also recommend embracing standards like OpenID and federated authentication/authorization solutions that enable wider access to existing UW Web-based tools.

(5) We also recommend creating a **“Research Commons”** to bring together researchers, the staff who support them, and central units to share information and identify collaborative opportunities. Too many researchers and their teams are simply unaware of the technology tools, resources, and expertise already offered by the UW— these should be described and even accessed on the Web in one place. Mechanisms for enabling group pricing for hardware, software, and research-related equipment are another important component of the Research Commons. Finally, the Commons should include both virtual and face-to-face communication channels to help members of the research community exchange information about their projects, their technologies, their facilities, and how they support their work.

Our recommendation for researchers and those who support them, especially technology staff, is singular: work with us to help build a culture of collaboration around supporting UW researchers. Consider technology solutions from central institutional units rather than building and buying your own. Or, consider collaborating on these solutions with others in the research community. Tell us and tell others about what projects you are working on, your technology needs, and what technology solutions work effectively for you. We and others will listen as we try to build a culture of collaborative, creative, and innovative technology support at the University of Washington.

ⁱ Office of Sponsored Programs and Grant and Contract Accounting, University of Washington. Annual report of awards and expenditures for the period July 1, 2006 to June 30, 2007, p. 7.

http://www.washington.edu/research/.SITEPARTS/.documents/.reportsAnnual/06Annual_Report_-_Fiscal_Year_2007.pdf