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ADVANCEMENT OF ACADEMIC RESEARCH COMPUTING AT UNCW

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## Abstract

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This paper discusses the current state of Academic Research Computing (ARC) at UNCW and the steps taken to enhance it as a service to UNCW research faculty. A review of national universities, including peer institutions, was completed to understand the research computing environment as a whole. Research faculty, ARC advisory committee members, and members of the Information Technology Systems Division were interviewed and asked to participate in surveys and questionnaires to gather information for a research needs assessment on UNCW's campus. This information, in conjunction with the national review, shaped the actions taken to fulfill the faculty's needs and to position ARC to better serve the university. These actions include creating a clear definition of the ARC program as well as building a business model, web site, web applications, and a marketing strategy. The paper concludes with a listing of future work to continue moving ARC forward.

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## Introduction

Academic Research Computing (ARC) is a broad phrase which can cover all manner of concepts, yet can still evade a brief definition. When told to someone unfamiliar with the term, most have to ask a follow up questions such as, “What does that mean?” From there, often times a confusing or long-winded explanation takes place. And even then, some walk away still not knowing what Academic Research Computing is.

At its core, the mission of ARC is to provide technology and support for research projects. From the statistician using a desktop to compute Bayesian Inference models to the chemist using grid computing to model how molecules react to one another, from the geologist needing abundant space for data storage to professor wanting to experiment with new teaching tools, faculty researchers rely on computing technology to aid in their studies, to run through hypothetical scenarios which range from impossible to impractical to conduct in a lab or even in a mainstream technology environment.

And while this research is important to a university and could possibly be groundbreaking for the world, these researchers are a group that has been historically overlooked or unaided by Information Technology (IT) departments [2]. Requests for equipment, software, and support often exceed what IT departments can provide, leaving faculty to rely on grant moneys for purchasing resources and the faculty to support the equipment and software themselves. This is a less than desirable situation for all parties; faculty have to spend more time focused on the IT portion of their project, taking away from the research, and IT departments have to worry about security and compliance on these disparate systems [5].

Fortunately, universities are starting to understand the need to not only support this cause, but to promote it. A research computing task force from the University of North Carolina at Chapel Hill puts it quite plainly in the opening paragraphs of their October 2008 report [4]:

*Excellence in research sustains the University's reputation, its ability to attract talented faculty and students, and its ability to compete for funding. Computing has become*

*fundamental to all fields of research. The University of North Carolina at Chapel Hill must develop a cohesive research computing program to assess needs, provide consultation, data storage, and data management, deploy hardware and software, resolve technical issues, and train individuals for computing competence.*

*The key question focuses on what kind of specialized resources and support users require (e.g., hardware, software, storage, programmers, designers). Rather than something on the fringe, something to budget in a good fiscal year, research computing—those doing it and those supporting it—defines us as an institution. Put simply, research is what universities do and with research comes computers, and with computers comes the critical need for support and a comprehensive cyberinfrastructure.*

Universities across the country are assembling departments whose primary focus is computing-based research. Notable universities with research computing departments include:

- Baylor University
- Dartmouth College
- North Carolina State University
- Portland State University
- The Rochester Institute of Technology
- The University of North Carolina at Chapel Hill
- The University of North Carolina Charlotte

Hardware and software are being purchased and dedicated to research purposes. Virtual computing is being utilized to remove the need for stand-alone servers and desktops. Personnel are being hired to assist in the many facets of support that comes with the unique work being done by researchers. The University of North Carolina Wilmington (UNCW) is also investing in research computing.

Academic Research Computing at UNCW strives to achieve the mission stated earlier - to provide technology and support for research projects. ARC, as it is informally called, has the following goals:

- Facilitate technology-based research
- Assist with research grant proposals utilizing IT
- Remove the burden of IT management from researchers
- Enable researchers to have more time for their research and less headache from technology
- Centralize support of products used by the research community
- Reduce costs by unifying common services and support
- Mitigate IT security threats by putting the onus of protection on trained IT staff

## Historical Review and Analysis

### National Review

A nationwide search was conducted to understand the services and scope other universities are offering in the field of research computing. As part of this search, information was collected on the types of systems and services the institute provided for researchers and any information on how the system got its start. Many seemed to focus on the high-performance and grid computing disciplines. Others offered these services in addition to more conventional IT services such as web and database hosting and mass data storage. Consistent across all schools that have already started their research computing programs is the realization that having quality research resources brings in quality faculty, and quality faculty brings in quality students, money, and acclaim [4].

When analyzing the configuration of these existing research computing programs, how the program is organized within the university was also considered. Some programs are centralized, some are decentralized. Some are funded by the academic division of a university, some receive backing from the business division of the school, and some are funded by the researchers themselves. These are key aspects when determining where the program falls on a list of priorities for a university.

Of the national programs reviewed, three specific examples are highlighted below. Figure 1 below notes other schools evaluated during this process.

### The University of North Carolina Charlotte

In the 2002-2003 academic year, the University of North Carolina Charlotte created its University Research Computing department, which is a section of its Information Technology Services group. The Information Technology Services group is a department within the Academic Affairs division at UNCC. Work had begun on this project in 1999 when an ad-hoc committee was assembled by then Dean Robert Snyder. His committee drafted a white paper on the importance and need for research computing on UNCC campus. One key aspect of this white paper was the call for new resources for this effort rather than re-tasking resources currently available through the Information Technology Services department or

elsewhere on campus. This was followed up by different proposals from academic groups and a task force assembled by then interim CIO Steve Mosier. Their goals were to create a system that was broad and capable of handling requests from various constituents across campus. They polled key groups on campus to gather feedback and found that the primary need was statistical analysis and processing power.

The University Research Computing group now offers its “ChargerNet” to researchers. This system consists of Linux cluster with 108 processors and two terabytes of data storage. Applications such as MATLAB and a program for weather research and forecasting modeling are available. They have also created a partnership program to create a high performance computing system. Rather than faculty purchasing their own smaller systems to run only their projects, they are encouraging faculty to contribute to the University Research Computing group so that the combined efforts can be put into a much larger, more robust, and more capable system. Faculty retain top priority on the resources they supply so long as others may use them when the resources are idle.

#### Portland State University

Another illustration is of research computing can be found at Portland State University. PSU has created its Research Computing group as a joint effort between three departments: Research and Sponsored Projects, the Office of Information Technology, and Instruction and Research Services. On the Research Computing website, PSU advertises a web server, database server, and general purpose clusters for their researchers. They list software support for programs such as MATLAB, SAS, and online mapping applications.

#### The University of North Carolina at Chapel Hill

The University of North Carolina at Chapel Hill has set up their research computing structure in a different manner. They have combined their efforts in the field with Duke University, North Carolina State University, and the state of North Carolina to create the Renaissance Computing Institute (RENCI). The institute’s goal is to pull expertise from faculty across multiple disciplines to create a more comprehensive environment for research.

While participating in RENCI, UNC has its own Research Computing division which reports to the Information Technology Services vice chancellor. The division list nine different physical, centrally located systems used for research computing on their website. These systems include:

- A 128 processor high performance computing system
- A 1024 processor Linux cluster
- A 352 processor Beowulf cluster
- 4 16 processor systems for scientific research and custom parallel code
- A 32 processor database server
- A bioinformatics server
- Chapel Hill makes 10 terabytes of storage available to these systems and its researchers

#### North Carolina State University

North Carolina State University has introduced a newer, more flexible example of research computing system. NCSU has partnered with IBM to create the Virtual Computing Initiative and Virtual Computing Lab [3]. This allows faculty and students to access a virtual lab from the Internet. They can tap into one of several pre-programmed computer images to receive access to a virtual computer designed for their needs. From general computing to conducting multi-processor modeling, the resources are available. Started as a smaller pilot program, the program is being expanded to include K-12 programs, community colleges, and other universities. This ability to gain access to the type of system required falls in line with the more modern thinking of research computing in that the technology can be designed to adjust to the research rather than the research having to conform to the environment. NCSU, with the help of IBM, has taken it one step further by automating the process, which will be helpful when more users are introduced to the system.

School	HPC/Grid Cluster	Virtualization	Data Storage	Data Backup	Web Server	Database Server	Dedicated Staff	Application Support	Centralized w/ Other IT
Baylor	✓						✓	✓	
UNCC	✓						✓	✓	✓
Portland St.	✓		✓		✓	✓		✓	✓
Dartmouth	✓		✓	✓	✓	✓			✓
UNC	✓		✓			✓	✓		✓
NCSU	✓	✓	✓		✓	✓	✓		
RIT	✓		✓				✓	✓	

Figure 1: Table showing national universities and research computing services

### Research Computing Trends and Challenges

As seen in Figure 1 above, many of the reviewed institutions have extensive resources. However, they are discovering that they locked into inflexible, physical systems that cannot specifically handle the unique needs of researchers' projects. From a October 2008 report by a UNC-Chapel Hill task force for research computing, "Their systems are not flexible in the sense that users cannot customize them for their research" [4]. The consensus of this report explained that users having to share resources must wait in long queues for their jobs to be run on one of a few super computers or clusters. It also concluded that ultimately, universities need more flexible environments for faculty research.

The model of partnering with outside entities for assistance with funding is also a step in a different direction for this realm. Most universities with research computing programs have placed them either under their academic division or their business and IT divisions, as seen above in figure 1. This means competing with other needs and services for recurring budgets to fund the research computing initiatives. Placement in each division has pros and cons. With research programs under academic leadership, it is likely that a system will stay funded and more easily keep focus on its research purpose.

However, this creates the possibility for a redundant IT infrastructure. This could mean additional money spent resources that are already provided to the university by the business or IT departments.

On the other hand, having a research division under the IT department would reduce the need to replicate infrastructure. However, having an IT department run a research program can lead to prioritizing issues if decisions have to be made between campus infrastructure and research infrastructure. For example, if a budget crunch hit would they divert money away from a research program to ensure that the university's email or website stayed up? If the IT department were already part of the academic core division, the problem is much easier. But for universities who have separate IT departments or IT departments under the business side of the organization chart, they must carefully evaluate the priorities of the research computing program in relation to other budgetary needs and plan accordingly for times of economic struggle. For these situations, the best solution would be to have an IT department control the hardware and utilize an academic committee or group to weigh in on policy.

Another major issue facing existing research computing programs is the way their infrastructure is designed. Despite efforts by universities to make these systems suitable for as many different disciplines as possible, the older, centralized systems are proving to be inflexible. This creates a problem for not only researchers, but to university administration as well. Originally purchased for their size and capabilities, many large-scale super computers and clusters are setup so that they cannot be adapted to fit different requirements demanded by new projects or simply are not designed for diverse or newer technologies. Because of this, if a faculty member determines that a system is not suitable for or capable of their research, they will turn elsewhere in search of what they need. This will leave expensive systems and highly trained staff underutilized or abandoned altogether. During tough economic times and for universities on tight budgets, schools are finding themselves trapped and unable to adapt to the current and future needs of researchers and faculty on campus.

As technology has progressed however, virtualization has created a solution to this problem. Large physical systems can be purchased or possibly re-tasked from previous assignments to serve as hosts in a virtual environment. These hosts then serve out many virtual machines, all of which share the host's resources. The virtual machines live in a cloud where processor, memory, network bandwidth, and even storage are used as needed. The virtual machines can run practically any software and allow for two projects to operate simultaneously on the same hardware without interfering with each other. This creates greater efficiency on the host computers and allows researchers immediate access to technology without having to wait in line for their job to be processed. For an up and coming research computing program at a university, virtualization allows the school to avoid the pitfalls of previous environments. Not many of the established programs are offering virtualization yet, but as more schools begin to implement it in their primary infrastructure, it is expected start to take root in research computing as well.

### Peer Institutions

Narrowing the scope of the search to UNCW's peer institutions, a group of similar schools determined by UNCW's Board of Governors, the work being done for research computing dwindles considerably. Of the fourteen peer institutions, only California Polytechnic State University (Cal Poly) has university-wide dedicated resources similar to those mentioned under the national review. Cal Poly has built a grid computing environment capable of running homegrown code as well as commercial software packages such as SAS, MATLAB, and PovRay. They have a central blade server and three terabytes of storage. Cal Poly's research computing is part of the university's Information Technology Services department, which is a subset of the Academic Affairs branch of the school.

Other peer universities are starting to show signs of moving into the researching computing area to facilitate the needs of faculty. The University of Northern Iowa has a faculty member who has designed a bootable CD which allows him to create a computing cluster out of an idle lab or workstations. The University of Texas at Dallas mentions having facilities for research, though none can be located on their website. For the other eleven institutions, no discernible information is available at this time. Figure 2

below outlines services, systems, and organizational structures for peer schools which have research computing programs.

School	HPC/Grid Cluster	Virtualization	Data Storage	Data Backup	Web Server	Database Server	Dedicated Staff	Application Support	Centralized w/ Other IT
Cal Poly	✓							✓	✓
N. Iowa	✓								

Figure 2: Peer institutions research computing efforts

### UNCW

The University of North Carolina Wilmington is a university of just over 12, 000 students. At the beginning of the Fall 2008 semester, it employed 851 faculty members. These numbers, for both student population and faculty have been increasing steadily over the past twenty years as the university has grown.

Accompanying the growth is increased research demands. Academic departments have sought more research-active faculty over the past decade. For example, the Department of Information Systems saw its active researchers go from two of members to eight in the last seven year. Reviews of available faculty positions posted on UNCW's Human Resources website shows that active research is a requirement for nearly every position.

The increase in research can be seen in the way of grant proposals and awards as well. According to information provided by the Office of Research Services and Sponsored Programs, in fiscal year 2004, 251 grant proposals were submitted. That same year, 222 awards were given, totaling \$19.7M. In just four years, those totals have almost doubled. For fiscal year 2008, 480 awards were given totaling \$38.2M.

This only includes research being done where external money is being sought. Many researchers continue to work on projects funded internally and subsidized by vendors.

This growth of students and research-active faculty coincides with a mandate to the university to grow its academic programs, specifically its graduate programs, over the coming years. But the trend of increasing the number of graduate programs is nothing new for UNCW. As stated in an email from Dr. Robert Roer, Dean of UNCW's graduate school, from 1998 to 2008 13 different masters or PhD programs were started. With graduate programs, which are typically more research intensive, and with more faculty coming onboard expected to perform research, the amount of research done on campus has increased. This has created a greater need for quality research resources, and as technology has become more easily accessible and widely requested, much of that need focuses on IT-based research tools.

UNCW's IT environment is centralized and administered by the Information Technology Systems Division (ITSD). This division is independent of the academic and business divisions on campus. It oversees most of the computing resources on campus, including faculty and staff workstations, student computer labs and classrooms, and the university's servers, networks, and other IT infrastructure. ITSD also houses the university's computer help desk, the Technology Assistance Center (TAC), which fields calls from faculty, staff, and students for all technology-related questions. Part of ITSD includes the department of Operations and Systems Administration (OSA). OSA is responsible for the planning, installation, management and support of the central computing and data storage infrastructure. ARC and its staff are a subset of the OSA department.

Historically, ITSD has not been in a position to leverage the existing technology infrastructure on campus to facilitate the needs of research being conducting at UNCW. With its focus on maintaining the primary computing infrastructure of the university, ITSD often could not serve the needs of researchers. This led to faculty members outsourcing requests to other entities, purchasing the hardware and software

themselves, or simply not conducting the study. It also led to a public relations problem where researchers felt ITSD was not meeting their needs.

In an effort to reverse this, members of OSA began brainstorming on ways to create an environment that would allow researchers to conduct experimental procedures while shielding the university's main infrastructure. The idea was discussed numerous times, but it was never feasible given other budget demands.

Gradually, the demand for a research-focused infrastructure got more traction. In 2007, the Vice Chancellor of the Information Technology Systems Division (ITSD), Dr. Debra Saunders-White, organized an IT advisory committee for ARC. The committee's charge was to make recommendations to Dr. Saunders-White concerning academic research on UNCW's campus; where they saw it currently, where they wanted it to go, and how they felt it should get there. With the committee being made up of researchers across campus from various departments and fields of study, the objective was that they could provide a cross section of the types of research being done on campus and voice the need of faculty. This committee and the feedback it could provide from the research community at large created a circular organization structure for ARC, as seen below in figure 3.

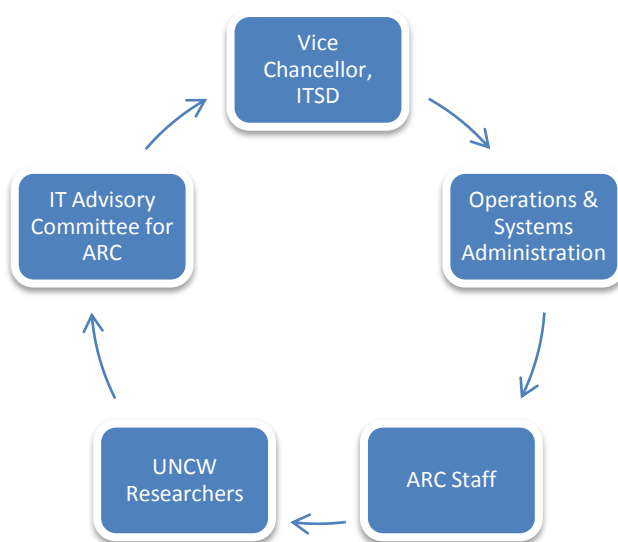


Figure 3: ARC organizational structure

ITSD then began dedicating resources to the ARC cause. These included:

- 6 Dell blade servers, each with 2x2.66 GHz Quad-core processors and 16 GB of RAM
- Over 1TB of dedicated storage
- A stand-alone active directory domain separate from UNCW's production domain
- Access to the VMware licenses for virtualization
- A half-time staff member to administer ARC and assist researchers with projects

### Needs Assessment at UNCW

With only a few early adopters currently using ARC, a new needs assessment was conducted to see what faculty needed in order to better perform their research. Digital surveys, questionnaires, and face-to-face interviews were conducted with the key stakeholders for ARC. These stakeholders include:

- UNCW Research faculty
- ARC committee members
- Members of ITSD

The faculty and committee members came from departments across campus, including Biology, Computer Science, Economics, Health and Applied Human Sciences, Information Systems, Math and Statistics, Operations Management, and Psychology. By talking with researchers from different fields who conduct varying types of research, better information was collected to understand the research landscape on campus and the different needs for technology in their research as well as ask what type of technology they needed to better assist them.

Statistical analysis is the most common need for technology pertaining to research. Virtually all researchers have data sets which need to be processed and analyzed. Many of the researchers at UNCW are using their desktops or laptops to crunch the numbers. These jobs run anywhere from a few minutes to several hours, depending upon their complexity and the size of the data set. For those using their desktops, the processing required to compute the data can cause the computers to become unusable for other day-to-day function, causing a loss of productivity or requiring the jobs be run at off-peak hours. Others have analysis jobs that require more computational power than a single computer provides. For this, they need access to a compute cluster or grid where their jobs run in parallel across many computer processors.

Another need for high computational power is for large simulations and modeling jobs. While not as prevalent as statistical analysis, a small group of researchers have jobs which required copious amounts

of processing. In order to run these jobs, faculty are using grids hosted by other departments when available, or are tasking desktops for one or several days.

Data storage and backup is another area where researchers have a need for technology. Faculty members are using their office and personal computers to store their research data sets. Most of the datasets being used by UNCW faculty are small enough to be stored on desktop hard drives. Larger data sets often require external disks. Fortunately, most faculty have a backup solution in place. It typically consisted of copying the data to an external drive or second computer. For most, the backup process was not a scheduled action and had to be performed manually. Many of the backups were kept together with the original.

The need for collaboration for researchers is common as well, especially those who are managing labs and research assistants. These faculty members are using online tools such as Google Docs and Google Sites to post information, create schedules, and share data. Faculty have the need to share information with sources both on campus as well as at other institutions.

Most of the researchers are comfortable with writing their own code and scripts to run their analysis and modeling jobs. They often require little assistance managing their hardware or software. When they do encounter problems or questions, they seek help from colleagues or a vendor. Faculty who need access to large compute clusters or grids would like to have additional manpower to help get jobs configured to run appropriately.

An important finding is that most researchers do not have large technology expenditures associated with their research. For the technology expenses they do incur, much is funded through grants when possible. In years when grant money is not available, they find help through their department or other avenues on campus. Money for software licensing is consistently the largest need. Currently, there is no centralized repository of research software on campus, so researchers have no means of knowing what is available on campus. If they cannot find free software through a vendor or a UNCW contract, they

have to buy a license for the software title they need. This typically allows them to run the software on only one or two computers.

Time management is also a concern for many researchers. Trying to balance a course load, student requests, and other obligations such as committees, researchers have to fight to find the time for their research. When they do have the time for their projects, they have deal with the management aspect of their technology, taking away from time with their data sets and analysis. During conversations for this project, many researchers mentioned that if they could have one thing to help with their research, it would be more time.

A key takeaway is how faculty prefer to learn about new information on campus or about research-based initiatives. Results are mixed with about half of those polled preferring communication to come through department meetings where they can learn about it first-hand. The other half prefer email as long as it catches their eye and shows value. With so much information being passed to faculty through email and in meetings, it is imperative to make communications useful to researchers to prevent it from being overlooked or dismissed. Also, with the rapid rate of change in technology, researchers need to feel comfortable that new services and support will be easy to use and available in the future.

While faculty are able to facilitate their research at UNCW by their own means, there are opportunities to provide better infrastructure, more automation, and dedicated support to academic research. Researchers do not have dedicated resources for analysis, data storage, or collaboration. They have to use their office computers and lose day-to-day productivity while their research jobs run. They have to remember to backup their data and fail to separate the backup from the original. They have to look for any means necessary to share data with colleagues and research assistants. These are problems that are solved by ARC.

## Value Proposition

The purpose of ARC is to provide technology and support for research projects. This includes making resources available for statistical analysis, for storage of research data, for automating and protecting data backup, and for making sharing information easier. By using ARC, researchers can focus their time and efforts on their work.

To support the need for processing power for statistical analysis, modeling, and simulations, faculty have access to their virtual machines. Projects can be moved to these resources to free up office and personal computers, allowing professors to continue their daily work while their projects run simultaneously. The systems are accessible from campus as well as from home and on the road. Research assistants can be granted rights to use these systems without needing to physically access a faculty member's office or lab. All maintenance on the infrastructure is done using redundant hardware, allowing for minimal downtime for maintenance. This redundant hardware also mitigates system failures from interfering with running jobs.

ARC addresses data storage needs by providing network-based folders to individual researchers where they can upload their data sets. Currently, many researchers are saving their data sets to desktop hard drives and external drives. Unfortunately, these drives are not fault-tolerant. If the drive were to fail, the data may not be recoverable. Data storage through ARC would live on hardware that can sustain a failed drive and continue to function. The folders for researchers can be setup so that they mimic a hard drive on the computer, creating no change in process for faculty and no learning curve. The storage would also be available from on and off campus, and control could be delegated to research assistants or colleagues.

Along with the data storage ARC has data backup. The network folders containing research data will be automated to backup nightly. Currently, most of the researchers interviewed are backing up their data, but it is done manually and at different intervals. Also, the backup is often kept with the original. A best practice for backups is to keep the backup in a separate location from the original to prevent losing

both in the event of a disaster. Backups of ARC data is copied to tape and kept in a secure vault at an offsite location.

To facilitate the need to collaborate, researchers have access to SharePoint, as web-based tool hosted by UNCW. While not specific to ARC, this tool is available to researchers so they can create sites for their labs and projects. They can use document libraries, calendars, wikis, blogs, and other online resources to keep all of their information in a single portal. The sites are backed up nightly as well. Currently only available to UNCW accounts, talks are underway to make SharePoint available to non-campus users as well.

Computing power for smaller projects, data storage, data backup, and collaboration are all available now. ARC also reduces the time spent managing technology by taking over the setup, security, and maintenance of the infrastructure and streamlining the project request process. With these services available but going unused, there is a need for better promotion of ARC. This is done by making information widely available to the research community as well as by going into the field to educate faculty on the existing tools that are accessible to them.

In the future, ARC will develop additional services to assist more researchers. Discussions have been underway to assemble a high-performance compute cluster to allow larger jobs to run across multiple processors in order to return results faster. Existing equipment can be used for this and the software license is already owned by UNCW. Once manpower is available and the cluster is assembled, researchers can run jobs much faster than what is currently available on campus.

Another future service for ARC is to consolidate research software. Currently, if research software is not available through a campus license, it is purchased by departments or through grants. This is usually done in small quantities to keep cost down. If multiple researchers could consolidate their orders, they could get better pricing and save money. By talking with researchers and asking what types of software they use, a collection of names and titles will be put together and made available to the

research community. Faculty could then see others on campus using the same software and seek to consolidate their licenses. This information could also let faculty know what others are using for different types of work, what is available on campus, and possibly establish new contacts and lead to a community where faculty could assist in peer-to-peer support.

### Actions Taken

Given the needs highlighted through the needs assessment and the value proposition available through ARC, several steps were taken to put ARC in a position to fulfill the requests of research faculty and make it a sustainable program. These included building a business model to show the overall layout for ARC and a service level agreement to illustrate how service contracts between researchers and ARC will be constructed. The next step was building a web site to make information about ARC available online to researchers and provide a location where they can learn more about the services. Following the web site, the subsequent step was designing a project request system that will take a user's input from a web form and convert it into an email sent to ARC staff. Creating trending data and storing it online was the next iteration, allowing ARC staff to monitor current data as well as view historical information about ARC on which they can base decisions about capacity. Since many of the needed services are already available, the final step was to put together a marketing strategy to get information about ARC to researchers and let them know what is offered to them.

### Actions – Building a Business Model

With data collected from ARC committee members, faculty researchers, and ITSD, and with solutions formulated to address the current needs, the first step of action was to develop a business model to support ARC. The business model consists of four parts: infrastructure, offering, clients, and finances.

#### ***Infrastructure***

The infrastructure of ARC consists of several components. There is the physical resources dedicated by ITSD including 6 blade servers on which the virtual environment runs, over 1 terabyte of available storage, a backup system, and licenses to run the necessary software. There are also staff resources with a half-time position being dedicated to ARC. Other staff resources are available through ITSD for specialized projects that require advanced skill sets.

#### ***Offering***

ARC's offering goes back to the value proposition highlighted earlier. ARC offers technology and support for research projects. Faculty have access to computing power for statistical analysis and

modeling, data storage and backup to store and protect their data, and collaboration tools to facilitate teamwork. All of this comes with local support from UNCW personnel, allowing researchers the opportunity to meet with and ask questions directly to the staff supporting their project. It also allows for the management of the technology to be outsourced and makes more time available for the faculty's research.

### *Clients*

The primary clients for ARC are campus faculty doing pure and applied research. These researchers come from many different disciplines across campus. Many have created their own research environments by running their analysis and store their datasets locally on their desktops. A few have access to larger systems either acquired previously or shared with other universities. Support for these clients has been very limited on campus, forcing the researchers to rely on colleagues and vendors for support of the technology used in their projects. In terms of channels available to contact these clients, research shows that word of mouth amongst colleagues is the most effective means of conveying information about ARC services, but that faculty also look for information in emails and departmental meetings. By connecting with researchers on campus, ARC can establish a solid relationship with the faculty and have a deeper understanding of the project at hand, allowing for more comprehensive support and a richer experience for the faculty member.

While pure and applied researcher are the primary focus for ARC, there are other market segments that exist and are potential ARC clients. Given its ability to host unique projects that have historically had nowhere to operate, ARC is a potential testing ground for faculty who want to experiment with software for the classroom. Early adopters of ARC include these types of projects and allow faculty to try software in a lab setting without having to procure new equipment or spend additional time understanding and installing hardware and software. Unfortunately, these projects are not easily identifiable. Therefore, ARC staff will inform other ITSD staff of available resources. When these ITSD

staff members find a potential candidate, they can suggest that faculty member contact ARC about hosting their project.

### ***Finances***

Finances for ARC are a two-tier process. Many researchers do not have large budgets for their projects. Most received grants which lasted one to three years. However, they often have years between grants where they must find funds elsewhere. ARC seeks to let researchers use services with little or no cost.

The first tier of ARC come with no fee. This tier encompasses most researchers on campus and is for projects where virtual machines are needed to off-load computing power and up to 20GB of storage is used. Virtual machines are available to researchers at no cost since the infrastructure is part of ITSD's current environment. Researchers can use them when they need them, and either shut them down or delete them when they are finished. Access to SharePoint for collaboration also has no fee associated with it as it is part of UNCW's current infrastructure. Similarly, all support for researchers would have no cost associated with it, keeping in line with UNCW's current model. Since faculty are not spending money on these resources, they will see no cost savings. However, they will see a savings in time and added convenience as they can compute results while they work and receive centralized support focused on research.

The second tier of financing comes into play for projects that require more than 20GB of space. Unlike virtual machines, data storage is tangible and has a direct cost associated with it. For requests over 20GB, data would be priced at \$2 per GB per year. All data would be backed up as part of the data storage service and have no additional cost. This price is likely to come down as storage becomes more affordable.

As part of the business model, a service level agreement (SLA) was drawn up and is used for all ARC projects. The service level agreement is based on previous agreements used within ITSD, but tailored to benefit research-based projects. It highlights the responsibilities of both the research and the

support staff, and shifts the tasks of IT management to the ARC staff to allow the faculty member more time to focus their research. To see a sample of the SLA, please see Appendix C.

### Actions – Developing a Web Presence

The web presence for ARC is a lynchpin to this project. It provides an easy to use, free medium through which information about ARC can be disseminated to potential and current users of the environment. It acts as a portal where after researching different options, users can submit a request for a project through a web form. It provides access to statistics which are collected on the back end of the environment and displayed in the form of a dashboard. It also serves as a location to post news about upcoming changes and maintenance to make users more aware of what is going on. The site can be reached by visiting <http://www.uncw.edu/arc>.

In an effort to satisfy the university's goal of a systematic look and feel for the website, the webmaster for UNCW set up a skeleton of the site using standard UNCW templates. To exhibit the similar styles of the two sites, examples of the UNCW homepage and the ARC homepage can be seen below in Figure 5.

UNCW Homepage

ARC Homepage

*Figure 5: Look and feel of UNCW and ARC homepages*

Once the layout of the site was completed, and with the completion of the business model and SLA, content for the site was added. Areas for ARC's mission, committee members, and information were created. The "information" section (<http://www.uncw.edu/arc/information.html>) was pulled from the SLA to provide continuity. A section was created to list services offered through ARC as well so those unfamiliar with the program can read up on different options available to them.

To give examples of the types of work being done on ARC, a page was built to highlight past and ongoing projects in ARC (<http://www.uncw.edu/arc/projects.html>). This will grow over time as more projects are requested and go live. This not only highlights those using the system, but details how they are using it. It provides real-world examples of how the different services can be combined to accomplish the original goal.

A section was also created to field frequently asked questions (<http://www.uncw.edu/arc/faqs.html>). This section is expected to grow and become a way for users to help themselves. As questions are fielded by the ARC staff, they add them to the running tab of common inquiries and post them online.

The website also serves as a portal to applications which handle project request and statistics on the ARC environment. With persistent links throughout all high-level pages, users can click a link at any time to view either the project request form or the web dashboard. Examples of these links can be seen above on the right side of Figure 5.

### *Actions – Building the Project Request Process*

New research projects which go through ARC use ITSD's project tracking system. This system tracks work from start to finish and is required for all new projects. The project request system designed for ARC falls in line with the mission to reduce the burden of IT on researchers. It is designed to streamline the process a researcher must go through in order to request a new project.

Traditionally, users contact ITSD through one of two channels: the Technology Assistance Center (TAC) or the Technology Needs, Assessment, and Consulting (TNAC) department. The TAC typically handles technology problems and smaller requests while TNAC deals in large-scale projects. In order to minimize confusion and put researchers directly in contact ARC staff, the project request system allows researchers to submit information about their project and have it sent directly to the ARC staff. This opens a dialogue to discuss the project, its purpose and its scope. The ARC staff can then assist the requester by helping them enter a project request into the project system used by ITSD.

The first method selected to design the project request system was to use an application programming interface from the project system employed by ITSD. The benefit to this was that the process would be very streamlined with the requester's input going directly to the committee that approves new projects. However, this method had many negatives. First, requesting new projects in the project system can be confusing. Second, that the project committee only meets once a week, meaning new requests may go unanswered for a small amount time before being addressed. Users may feel a disconnect with this and lose interest or become frustrated with ARC. Finally, the project committee may not have the most up to date knowledge of what ARC's capacity is at the time of a request. A project could be approved and resources not be available, or the opposite could occur where a project is declined when it could have been fielded.

Therefore, a second design option was used where requests for new ARC projects would come to the ARC staff first. This allowed a speedy response to the inquiry. It also let the requestor know quickly if the project they requested could be handled by ARC given current demands on the infrastructure. It facilitated direct communication about the requirements of the researcher's needs. It also allowed for ARC staff to assist researchers when they were ready to formally enter their project into ITSD's system.

The ARC project request system was designed to take input from a researcher through a web form, then generate an email and send it to an address for ARC staff. This involved using the PHP

scripting language. Since the web server hosting the ARC web site does not allow for scripting, a second server was used to handle the PHP portion of the system.

The web form (<http://www.uncw.edu/arc/request.html>) asks a user for their name, contact information, and a brief description of their project. An example of the web form can be seen in Figure 6 below. It then passes that information to the second server on which a PHP script is running. The script moves the data from HTML and put it into PHP variables. As it is put into variables, the TRIM function is used to clear off any unwanted white space on either end of the string. Once loaded as variables, the data is checked to make sure it meets the requirements, which are that the Name, Email, and Comments section all contain information. If they do not, the user is returned to the form with an error message stating that required fields need information. If the data passes the checks, it then moves into the process of building the body of an email message. The message is then sent to a mail-enabled public folder for ARC using the MAIL function. Finally, the script calls a webpage notifying the user that their request was successfully submitted and that they will be contacted soon. For more information on the PHP script and HTML code used in this process, please see Appendix D.

University of North Carolina  
UNCW WILMINGTON

Home  
ARC Home

ABOUT UNCW | ACADEMICS | ADMISSIONS | ARTS | ATHLETICS | GIVE TO UNCW | LIBRARY | RESEARCH

Academic  
Research  
Computing

Mission  
Advisory Committee  
Information  
Services  
Projects  
Documentation and FAQs

Request for Project  
View ARC Dashboard  
Email ARC

Request for Project

\*required field

\*Name:

\*Email:

Phone:

Subject of Request:

\*Your comments:

Submit

This site maintained by P. Iliyan (piliyan@uncw.edu) | [About this Site](#) | [Copyright Notice](#) | [Feedback](#)

Figure 6: Request for Project web form

### Actions – Building the Dashboard

A web dashboard for ARC was important to show usage trends. In order to forecast how potential projects will impact the infrastructure, ARC staff need historical information to see how the environment is performing over time.

Given the constraints of the web server hosting the ARC web site, a page could not be designed to run in this environment as it would not show dynamic graphs, store historical data, or show trends. Also, monitoring systems are already in use in ITSD, meaning development of a new system would create unnecessary redundancy.

By utilizing the existing infrastructure within ITSD and by using the simple network management protocol (SNMP) message options on the ARC infrastructure, data is gathered regularly. Statistics for processor, memory, disk, and network usage are tallied. The data is stored within the monitoring system and is available for trending. Also, the data is available in graphs online.

Though this was not the original plan, using ITSD's infrastructure is a better fit for the ARC dashboard. It provides all of the information necessary, shows the historical trends to allow for future decision making, and makes it all available online. It also eliminates redundancy, management, and overhead a third monitoring system would create. The only downside is that it is not public. A decision was made that this data was primarily administrative and most useful to ARC staff. Understanding the concepts behind virtualization and shared resources may not be easily conveyed to ARC users and therefore may make the statistics and graphs seem skewed when viewed. There is a project currently underway to explore adding scripting to the primary university web server, at which time scripts can be written to incorporate these graphs into a public page for user by ARC users. The dashboard landing page can be found at <http://www.uncw.edu/arc/dashboard.html>. For examples of the dashboard, please see Figures 7 and 8 below.

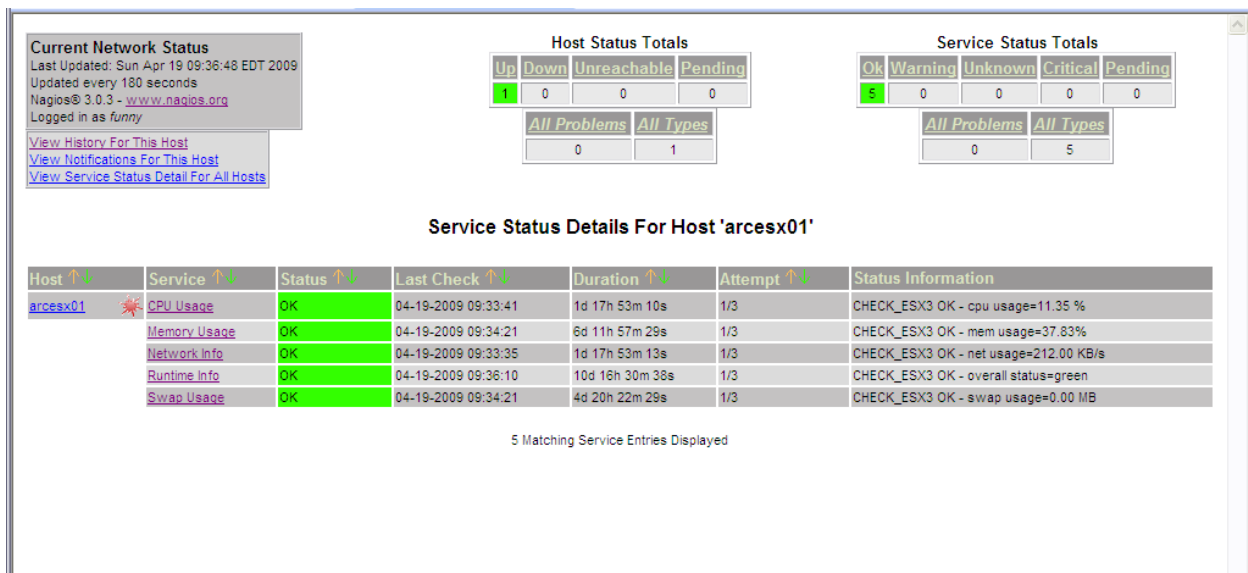


Figure 7: Dashboard for Host "arcesx01"

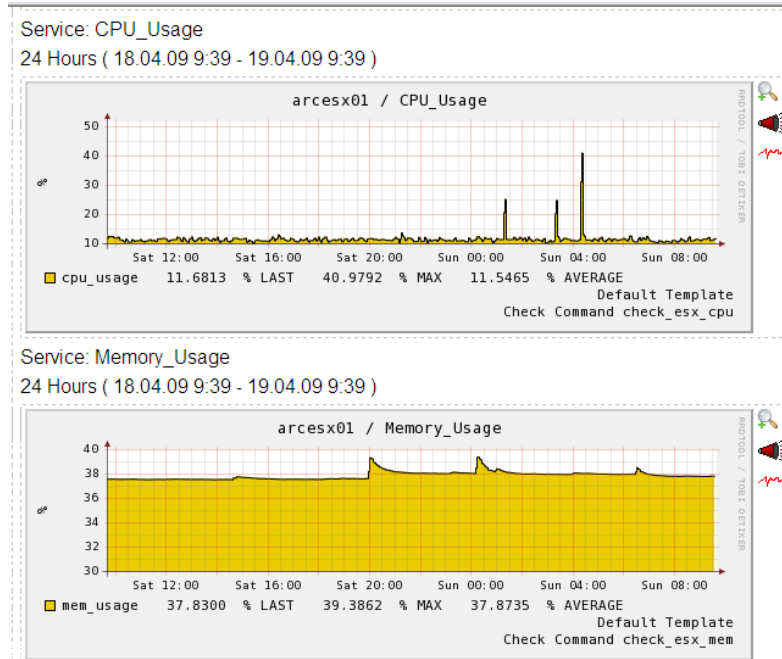


Figure 8: Data trending for Host "arcesx01"

### Actions – Designing the Marketing Plan

In order to get the information about ARC to the faculty researchers on campus, a two-fold marketing strategy was devised. The first step places information about ARC in the public domain. This includes the web site going live, linking to the web site from ITSD's web page of available services, and profiling ARC in an article in the "Technology Corner" on the internal UNCW faculty and staff web site "@UNCW". The goal of this to highlight that ARC is available to any that come across these publications.

The second step is to directly target researchers through an email campaign as well as attend department and committee meetings to discuss the services available through ARC. Through the needs assessment, faculty members are split when asked if they preferred communications about new services to come through email or through face-to-face meetings. The common thread is that word of mouth within the research community is preferred over both. Therefore, both email and meetings will be used to inform the research community, highlighting services available as well as past and current clients using ARC.

One suggestion which came from interviews with faculty members is to create a mailing list where faculty can sign themselves up. This creates a sense of ownership for researchers in terms of communications and would allow mail to be targeted to just researchers. The messages would still need to show value such as a new service or maintenance issue so faculty do not remove themselves from the list or, and be distinguishable to prevent faculty from ignoring the messages.

In order to make ARC identifiable, an ARC brand will be used on all communications. The brand is simple and to the point. It is an image with the ARC acronym, containing the full title of Academic Research Computing beneath it. It is comprised of the UNCW colors so as to identify it as a university service, and uses all capital letters in a professional font to highlight its professionalism. The image is accompanied by the tag line "Providing Technology for Research". The brand will be used extensively on the website, on emails sent by ARC staff, and on written documentation such as service level agreements with faculty.

## Conclusions and Lessons Learned

In review of this project, though objectives have been altered on occasion in order to maintain compliance with ITSD and UNCW policy, the objectives set forth in the project proposal have been met. A journal of events has been kept and added as an appendix to allow a reader to chronicle the journey of taking an academic research computing program from its early beginnings to a full production scale. A business model has been put together to outline policy for ARC and to serve as the groundwork for future growth. A web presence has been launched with detailed information about ARC made available on the Internet. In conjunction with the information presented online, a template for a presentation to be given to key groups on UNCW's campus has been assembled. Web applications have been built and deployed, which allow for users to submit requests for projects online from the ARC web portal and administrative staff to monitor and view trended data about the ARC environment. Finally, a marketing strategy has been put together and it is ready to be put into action to inform the campus community that ARC is ready for their projects when the green light is given by administration.

During both the project proposal defense and throughout the journal, a hypothesis was made that getting information from people and having everyone on the same page would prove to be the hardest part of this project. This hypothesis was proven true. Gathering feedback from members of the ARC committee was difficult. Given the requirements of their daily jobs and the fact that the committee had not met in roughly a year, it is understandable that some of the members were not able to provide feedback. For the members who did offer responses to the survey, many had differing opinions for their visions of ARC. Therefore, the lack of response and the mixed tenets put more decision making onus on this project. Fortunately, ITSD management has been in agreement with the decisions made regarding the business plan and marketing strategy and ARC has moved forward, meaning it is closer to fulfilling the goal of satisfying the demand for research computing at UNCW.

### Future Work

Though this project has come to a close, work on ARC will continue. The needs assessment for this project show that some faculty have projects with requirements that exceed what is currently available. Designing a high-performance compute cluster to handle these jobs gives ARC and the research faculty at UNCW another resource to help process large datasets in less time.

With most of the funding for current projects going towards software licensing, building a database of available software titles through the university as well as titles being used in niche areas can help to reduce costs and promote a peer-to-peer support community. By making this information available, researchers will first know what is available through UNCW. If the software they need is not offered through UNCW, they can see if other researchers are using it. If so, these researchers can look for opportunities to reduce cost by buying a larger license together. Also, by identifying researchers using particular titles, others can see who may have knowledge about certain software and seek them out for help. Many researchers already turn to colleagues for help. This can foster more peer assistance across campus.

Future work will also include continuing to publicize the efforts of ARC. Through the website, information on new and current projects will be posted for others to review and use as examples. Also, news about ARC will be listed on the site's homepage. The Technology Corner and @UNCW will continue to be utilized to convey the message of ARC to the campus and new faculty will be informed during their new faculty orientations. Additionally, if the new university web server is put into production with the ability to run scripts, data collected by the Nagios system can be ported into a public web page for ARC users to view.

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## References

1. "Academic & Research Computing Services". *Baylor University* || *Technology for Faculty*. Baylor University. September 30, 2008. <http://www.baylor.edu/lib/factech/index.php?id=39613>
2. "High Performance Computing at UNC Charlotte". *University Research Computing*. 2008. University of North Carolina Charlotte. September 20, 2008. <http://www.urc.uncc.edu/urc/>
3. "IBM-based Lab Improves NCSU Educational Experience". *CSC News*. October 20, 2006. North Carolina State University. January 9, 2009. <http://www.csc.ncsu.edu/news/429>
4. Magnuson, Terry, et al. "Provost's Task Force on Research Computing". October 8, 2008. University of North Carolina – Chapel Hill. January 9, 2009. [http://its.unc.edu/Research\\_Computing\\_TF\\_Report.pdf](http://its.unc.edu/Research_Computing_TF_Report.pdf)
5. "Research Computing". 2007. Portland State University. September 24, 2008. <http://www.research.pdx.edu/index.php>
6. "Research Computing". *Academic Computing*. 2008. Dartmouth College. January 9, 2009. <http://www.dartmouth.edu/~comp/about/departments/academic/research/>
7. "Research Computing". *UNC Chapel Hill* | *Information Technology Services*. 2007. University of North Carolina Chapel Hill. January 9, 2009. <http://its.unc.edu/research-computing.html>
8. "Research Computing". *Wolftech*. September 13, 2007. North Carolina State University. January 9, 2009. [http://www.wolftech.ncsu.edu/support/support/Research\\_Computing](http://www.wolftech.ncsu.edu/support/support/Research_Computing)
9. "RIT's Research Computing". Rochester Institute of Technology. January 9, 2009. <http://rc.rit.edu/index.html>
10. "Virtual Computing Initiative". *NC State* | *IBM*. North Carolina State University. January 9, 2009. <http://www.ibm.ncsu.edu/vci.php>
11. Pennell, Matthew. "Building a Bulletproof Contact Form with PHP". October 15, 2007. *Digital Web Magazine*. March 15, 2009. [http://www.digital-web.com/articles/bulletproof\\_contact\\_form\\_with\\_php/](http://www.digital-web.com/articles/bulletproof_contact_form_with_php/)
12. "ASP, PHP, CGI Email Form Scripts". 2006. *Tele-Pro.Co.UK*. March 15, 2009. [http://www.tele-pro.co.uk/scripts/contact\\_form/](http://www.tele-pro.co.uk/scripts/contact_form/)
13. "Faculty – Rank and Status". 2008. University of North Carolina Wilmington. April 21, 2009. [http://www.uncwil.edu/oira/documents/FactSheets/Faculty%20Staff/Faculty\\_Rank\\_Status\\_Fall.pdf](http://www.uncwil.edu/oira/documents/FactSheets/Faculty%20Staff/Faculty_Rank_Status_Fall.pdf)
14. "Research Computing Support Strategic Plan". 2002. University of North Carolina Charlotte. April 22, 2009. <https://www.urc.uncc.edu/urc/wp-content/uploads/2008/04/strategicplan.pdf>
15. "Grid Computing". 2006. California Polytechnic State University. April 22, 2009. <http://www.gridcomputing.calpoly.edu/index.html>

16. Gray, Paul and Wanous, Kristina. "A Computational Wet Lab for Distributed Computing". December 12, 2006. University of Northern Iowa. April 22, 2009. <http://bccd.cs.uni.edu/>
17. "Office of the Vice President for Research". April 20, 2009. University of Texas at Dallas. April 22, 2009. <http://www.utdallas.edu/research/>
18. "Marketing Plan Outline". 2007. QuickMBA. April 22, 2009. <http://www.quickmba.com/marketing/plan/>
19. "Business Model". 2010. Wikipedia. March 20, 2010. [http://en.wikipedia.org/wiki/Business\\_model](http://en.wikipedia.org/wiki/Business_model)

## Appendices

### Appendix A – Journal Entries

#### **Journal Entry – January 23, 2009**

Day 1. At least in a way. Today was the defense of my proposal to build a business model and prepare a marketing strategy for the Academic Research Computing (ARC) initiative at UNCW. Also included in the proposal are plans to create an online application process for access to ARC and a web-based dashboard to show utilization of the ARC systems. I open with “Day 1” because one of the notes from my proposal defense is to create a more tangible example of the human side of this process, which means the final draft to the proposal is not yet finished. Tonight I will begin a revision to the proposal which includes encapsulating the work done to develop the business model and marketing strategy in the form of a journal.

Maybe I am putting the cart before the horse in a sense by starting my journal before the final draft of the proposal is submitted. But, since the concept is to capture the activities from start to finish, there is logic behind starting the journal right away.

Another idea that came from the proposal defense was to make some predictions or hypotheses about the project. They could range from goals to problem areas. As such, I thought I would make a prediction about both a goal and a problem area. Starting with the latter, I was asked in the proposal defense what I expect the most difficult part of this project to be. My first thought is still my biggest concern – people. The ARC initiative is in a way the servant of two masters: the ARC committee made up of faculty researchers and staff from multiple academic and administrative departments across campus, and the division of Information Technology Systems (ITSD), which houses and runs the equipment on which the researchers will conduct their work. The committee is responsible for setting the direction for the program, but ITSD is supplying the initial equipment, is handling the setup of the environment, and will administer the program. Because of this physical split, getting everyone on the same page is

paramount. And if acquiring feedback from members of either group is slow going, or if finding common ground is difficult, there could be delays that cause stress for me, the project to run long, or both.

However, the problem of having so many people involved is possibly the best asset. In terms of goals, my goal would be to provide a quality computing environment for those who have trouble finding access on the university's primary (aka production) technology architecture. If everything goes to plan and we are ready to announce the availability of the ARC program campus-wide, having these key participants on board will only help to spread the word about the program and its benefits to researchers on campus.

**Journal Entry – January 30, 2009**

The final draft of my proposal has been submitted. It includes more information about the benefits of the web applications proposed in the plan as well as the concept of the journal. Basically, the project will become – or now is – a living case study about how to go about implementing a campus-wide academic research computing environment.

By submitting my final paper at the end of January, I know I will be on an accelerated timeline in order to maintain the schedule I set. My goal is to have everything in place by the end of this semester so that when the time is right, the marketing plan compiled as part of the project can be enacted and ARC can come to life.

Thinking about that last line, I can imagine to someone looking in that it seems odd to prepare a project and not pull the trigger on it. It would be like preparing for a marathon; putting in all of the training time, walking up to the start line, hearing the gun, and then turning around to go home. But unlike a marathon, there is more to running this race than just will power. ARC runs on hardware, uses software licenses, and needs support staff. Some of this is already in place, but if expectations are exceeded, additional resources may be necessary. This means money, and money puts a new twist on this project.

We can design the best system in the world, but if we announce that it is available and everyone wants access, we need to be able to handle the demand. I remember stories from the dot-com era where sites would go live and not be able to keep up with demand. It is nice to think that so many people are interested in your product or service, but if they want it and cannot get it, they may get turned off and choose not to try it when it is available. Given the current economic situation in the country and within North Carolina, budgets are tight. If recommendations for ARC include upgrading equipment, or if forecasts show heightened desire for access, ARC stands to have a negative backlash from those who want to get on and cannot. Since I cannot dictate how ITSD or UNCW use their budgets, I can only get them into the driver's seat. They will have to be the one that turns the key.

**Journal Entry – February 5, 2009**

The first real action that needs to be completed is to start talking to members of the ARC committee. As a staff member in ITSD, I already have a good idea of what resources are available and that the division is committed to the success of the program. With that, I have emailed the co-chair of the ARC committee, Dr. Karl Ricanek, to setup a meeting where we can discuss what he hopes to see come from the ARC initiative. It should also be mentioned that Dr. Ricanek is also the chair of my advisory committee for this graduate project.

In preparation for the interview, I have prepared a short questionnaire to get a feel for what he hopes to see come from ARC, how access should be determined, and how he thinks we can overcome obstacles such as funding and the current budget crunch. My hope is that this will provide a general understanding of what he thinks ARC is and should be. Using this questionnaire, I plan to solicit the same information from the other ARC committee members and use their feedback to assemble a basic groundwork for the program. I also expect that the questionnaire will serve as a catalyst to deeper conversations about expectations and ideas for the ARC program.

**Journal Entry – February 11, 2009**

Despite not being able to meet due to extenuating circumstances, Dr. Ricanek was able to review my questionnaire and offer feedback. I have taken his notes and updated the questionnaire. Given that time is tight, I have decided to email copies of the questionnaire out to the members of the ARC Committee. I am hoping to attain responses from a majority of the committee members over the next week so that I may get an idea of where they see the program going.

The key information I hope to obtain will be how to fund the program, what types of requests should be fielded by ARC, and who should be given access. I have asked other questions such as who the committee members see as the key players, possible obstacles that will need to be addressed, and what they see as the timeline for the development of the program given the current economic situation.

I plan to send the questionnaire out soon with hopes of getting feedback as quickly as possible.

**Journal Entry – February 19, 2009**

Today I had a meeting with the UNCW webmaster concerning the ARC website. I had requested that she prepare the standard templates for a university site so as to provide continuity for the look and feel of the website. I see the web presence as a key factor in the success of ARC, as I plan to use it as the primary information resource for the program. During presentations and within the marketing campaign, I plan to direct users to the website for more information on the programs, for details of past and current projects utilizing ARC, and as a portal for requesting access to the resources available.

My request for the web site comes at the same time as a redesign of the ITSD website. The webmaster and another staff member on the division's website committee requested a meeting to discuss the placement of the website within ITSD's new web design. Their initial idea was to incorporate the ARC website in with other "Educational Technologies". This would put the standard ITSD menu on the left side of the screen and the ARC-specific menu on the right side. Whereas the standard template is common through the university's website, I find that the right side menu is less intuitive. In class I have been told about studies where web users tend to read in an "F" pattern, going across the top of the screen, down the left side, and across the middle. With the menu on the right side and the standard ITSD menu detailing information about the division on the left, I feel users might be confused if directed to the website without first browsing through the ITSD site.

With this concern, I asked if the ARC website could be its own site, but yet still maintain a landing page within the "Educational Technologies" page on the ITSD site. I think it is important to have a connection to the ITSD site, as many will think of ITSD first when thinking of technology on campus. But since the program is not solely an ITSD venture, but rather a multidiscipline effort amongst many departments, we agreed that the program needed its own site.

I think this will be beneficial down the road for users who are given information about the program. They will be able to browse what is hopefully a very easy site to navigate to find the

information they need. An easy to use interface for the web presence as well as the web tools was one of the goals of the project. And from there, they can begin their journey with ARC.

**Journal Entry – February 20, 2009**

To expedite the process of getting feedback from the committee member of ARC, today the updated questionnaire was emailed to all of the members. I am hoping to receive quick responses that I can use to compile an overarching vision from the committee for the ARC program.

I realized (somewhat after the fact) that sending the questionnaire via email on a Friday afternoon may not be the most effective tactic. If someone does not check their email over the weekend but receives a lot of mail, they may not see my message. I intend to use standard survey methods and send a follow up email on Thursday morning to those from whom responses have not been received.

**Journal Entry – February 23, 2009**

An unexpected event occurred over the weekend and today. Some members were quick to fill out their questionnaires and offer information. However, I have had a few responses from members of the ARC committee that have inquired as to what ARC is. The committee has not met for almost a year according to one respondent, which seems to have put the program out of their minds.

I fear that with the ARC program being out of mind for members of the steering committee, getting a general consensus for the definition of the program details may prove difficult. This information is a lynchpin for other steps of my project. Plans for the web presence, marketing plan, and presentation to be given to stakeholders and potential users – they all depend on the information and feedback from the committee members.

**Journal Entry – February 26, 2009**

After more than a week, I have received only three completed questionnaires from the ARC committee. A few members have written back to say that they are no longer participating on the committee or do not know enough about it to offer good suggestions. Others have ignored the request altogether.

In hopes of pulling in a few more responses, I have resent the email with the questionnaire to the remaining committee members from whom I have not received a response. The previous email was sent on a Friday, so it is possible that the message was lost in the Inboxes of those recipients. Today's email was sent on a Thursday just after noon. I am hoping for a higher response rate, though I am beginning to fear that getting feedback from the committee is going to prove my initial prediction of being the most difficult portion of this project.

**Journal Entry – March 02, 2009**

Having sent a second email to the remaining committee members of Academic Research Computing, I have only five responses as of today. I have been told that one or two more are forthcoming. I am very thankful for those who have responded, knowing that this is a very busy time. Their responses will serve to provide some direction on which the remainder of this project will be based.

In reading through the responses, another one of my initial concerns is starting to come to fruition – getting everyone on the same page. I came into the project as a staff member of ITSD after the early groundwork had been laid. I am not sure how much conflict there was in the first few meetings about how ARC should serve UNCW, who should have access, or how it should be funded. It seems the respondents to the questionnaire I sent a week ago have different ideas and visions for this program.

But this can be a very good thing. One of the interesting topics I discovered while doing preliminary research was that many universities had found themselves almost pigeon-holed by their ARC-style programs. They had decided to go down one particular path and found that they could not service all faculty that wanted to participate in their program. By knowing this ahead of time, and with suggestions being put forth by the committee members that range from high-performance grid computing to experimental academic applications, we have a better chance of building our environment to meet all needs in terms of breadth. This may leave some wanting more, though.

If resources are divided amongst more services, capital to fully develop any one particular service will certainly wane. But I am not sure how you compare the proposed services against one another. Do you look at how many users a service could satisfy, or how much grant money a service could generate? Do faculty with seniority take precedence? Are some projects considered more mission-critical, or are they weighted equally in the eyes of the university? These are questions to be answered before we walk too far down the road, but I have another idea.

I personally think we should choose breadth over depth. This is just an innate feeling, but I believe if we offer more services with limited capability and explain that with buy-in from the would-be users it could be more fully developed, we can get more investment in the program and generate more revenue for future growth. Also, I think by only growing one service, others across campus may turn away from the program and lose curiosity in ARC. Perhaps it is an idealistic dream, but I think if you showed researchers what it could be with their help, they will be inclined to get involved. If we can only show one thing and it does not satisfy that particular researcher's need, despite being fully funded, they will likely abandon the program. And for those who are satisfied by the one service, it is likely they would want their contributions to further fund that service, making growth of other areas more difficult.

**Journal Entry – March 06, 2009**

Having had a week to read through the answered questionnaires and speak to the director of Operations and Systems Administration (my boss), it looks like a broader system is a better course of action for the university rather than a system that is more limited in access. This means developing an initial business strategy that supports more types of researchers while possibly sacrificing depth in a particular area of research. Over time with buy-in from the university and research community, we will make strides to add support to all services which require it.

So, with this decision being made, it is time to start development of documentation. The starting point will be a service level agreement (SLA). This will be a boiler-plate document which can be published online. It will outline a basic agreement between the ARC program and a researcher. Of course additional stipulations can be added as needed, but it will let faculty know what they can expect from the outset. It will provide some transparency to the process as well.

After the SLA, I can begin putting the website content together. The site itself is already online, but it is just an empty shell. With the SLA formed, I can better describe policies and answers to what I expect to be frequently asked questions.

**Journal Entry – March 13, 2009**

This week has been all about policy. I have a rough draft of the service level agreement (SLA) for the ARC program. This will be a template from which agreements regarding service for individual projects will be based. I will be submitting it to the director of Operations and Systems Administration in ITSD under whom the ARC program's infrastructure is run. A large portion of the SLA will outline how the systems will be handled as well as what can and cannot be done.

The SLA has led to information that can be broken out and put into the ARC web site. Pages about policies and answers to what I expect to be frequently asked questions about policy and filled with information either from or inspired by the SLA.

With these rough drafts created, it is time to move on to other portions of the site. This includes putting up information about past and current projects and details about what services are available through ARC. Once these are completed, most of the static content will be online. It will need polishing over the next couple of months before it goes live, but the bulk of the writing will be done.

After the static content is completed, the application development will begin. This will include extracting data from the ARC environment and creating a web-based dashboard. I plan for this to be a mash-up of several statistical readings about the servers running the environment. Also, there will be a project request system where potential users can send in requests for access to the project. More research is required in order to see if there are any constraints in how these will be developed given the current setup of UNCW's web servers.

**Journal Entry – March 20, 2009**

I have completed all of the content for the static pages on the ARC site. I am asking the director of Operations and Systems Administration to review the site to make sure it is in compliance with the vision of ITSD. While he reviews the site, I am moving forward with the application development portion of the project.

I first want to develop the project request system. I have already found a couple of snags. First, ITSD has a system for vetting and assigning projects. So as not to create a redundancy, the idea is for ARC projects to be routed through the same system. The system not only decides whether or not a project should be done, but also when and by whom. It allows for management and state auditors to track time spent on particular projects and follow the process from start to finish so they can review how monetary allocations are being used by ITSD. The trouble with routing ARC requests through this system is that it will likely be difficult for the project committee to know exactly what capacity ARC has for new projects, or if the new project requests fit into the scope of ARC. Since it is a unique entity within ITSD, and since it is very new, not everyone is going to be well-versed in what is possible at this time.

Therefore, I have purposed a new idea. Originally I had planned to use an ASP.Net API to have users fill out a form and submit it into the project system. Now, I will have them fill out a form which routes their information to the ARC staff first. From this point, the staff can work with the potential user and develop their idea. When the time for development and implementation comes, the ARC staff (being part of ITSD) can assist the user with submitting their project request more formally through ITSD's system.

I have created the online form which the user will fill out. I discovered after emails with the university webmaster that the web server on which the ARC site is running does not support ASP.Net or any other type of scripting language. So, I have chosen a different path. I have created a PHP script that can run on another server. The web form will make a call with the appropriate data to the PHP file running on a separate server. The PHP form will first check the data. If it does not meet the necessary

criteria, the script will send an error back to the main web server and inform the user that an error has been made and ask them to complete the form again. If the form does meet the necessary criteria, it will assemble the data into a format to be sent via email. The email will be delivered to a public folder in UNCW's email system for access by the ARC staff. A copy of the email will also be forwarded to the ARC staff directly to inform them of a new request.

The revelation that the primary web server does not support programming languages is also going to cause a setback concerning the web dashboard. I had originally intended to setup graphs and store data using ASP.Net and a database. Not being about to use this code on the web server leaves me with a dilemma. I want to keep the site together for manageability and continuity, but I want to have the information needed to complete the dashboard task. Perhaps I can utilize another resource within ITSD and host the statistics there.

**Journal Entry – March 27, 2009**

With the online request form working, I am moving on to the Dashboard application. Since almost the entire ARC environment is virtual, the data to be collected from the ARC system will come from the host machines providing for the virtual world. Fortunately, they use SNMP to send messages about their status and the status of the guest operating systems (the virtual servers and workstations). This is beneficial because ITSD already has a system for monitoring SNMP messages. We use it to monitor our datacenter. As I do not want to recreate systems ITSD already has in place, I intend to add the ARC hosts and guests to the monitoring system and then pull data from it to populate the dashboard.

In speaking with the administrator for our monitoring system, it looks like we can easily add these hosts and guests into his system. We are starting with hosts that are not currently included in the ARC cluster. We will let them run for a week or two to make sure there are no problems before employing the service on the hosts that are in production with guests running on them. Assuming testing goes well, we will implement the live hosts and start collecting data. I will then migrate the data to the main web server to populate the Dashboard page.

**Journal Entry – April 03, 2009**

Testing for the Dashboard data collection has gone well. Due to other demands, I was unable to work on the Dashboard this week. I plan to attack it next week and have it running by week's end.

I was able to work on the marketing plan for ARC however. Since budgets are tight, my plan is to get ARC ready to be deployed, not actually deploy it. If it is a success (as I hope it will be), we will have to meter requests so as not flood the system and ruin performance. The only way to maintain performance and handle increased demand would be to purchase and deploy more hardware and software, which comes with a price tag. Since meeting that price tag could prove difficult, my end-goal is to present a ready model to ITSD management and ask them for a green light to proceed with the understanding that success of the program will either mean having to draw a line or require more funding.

In thinking about how to advertise the program, I spoke with Tara Thompson who handles most of ITSD's public relations. She maintains "The Tech Corner" on the @UNCW webpage and has a voice within @UNCW. (@UNCW is a campus communiqué website aimed at UNCW faculty and staff.) She informed me that with the restricted budget, advertising dollars are few and far between. However, she believes that putting information in The Tech Corner and possibly on @UNCW directly would be easy to do and would require no cost. I asked about having the student newspaper, The Seahawk, write an article. She said that articles are decided on by the paper's student staff. I am going to speak to the editor as well as the faculty liaison for the paper and get a better understanding of their circulation amongst faculty and staff. Whereas students will be able to access the ARC system, it will only be through projects requested by a faculty project leader. If the newspaper does not have enough contact with faculty, then having an article in it may be a moot point.

Another aspect of the marketing plan will be to inform new faculty of the ARC system when they go through orientation. I spoke with the director of Technology Enhanced Learning, Jeff Stanfield, about what ITSD does with new faculty orientation. He talked to me about the 2-day whirlwind new faculty go through. He said that ITSD is typically invited to speak to the new hires during each orientation; once in

the fall and once in the spring. He also informed me that the orientation is run by the Center for Teaching Excellence, another campus department, and that I could contact them if I wanted to do something outside of ITSD's role.

I reviewed some literature that ITSD provides to new faculty. It highlights many of the systems that ITSD provides to the campus community. I believe a small blurb about ARC would be a perfect addition. I will work with Jeff to include something in this year's fall handout. Also, I will work with ITSD's representatives and CTE to see if a small presentation about ARC can be done during the orientation sessions.

## Appendix B - Questionnaires

- How do you envision ARC serving the campus?

*We need an academic research support system for faculty and student research. This is for folks with all types of statistics abilities.*

- Who do you think should have access to ARC resources (research faculty only, all faculty, grad students, etc.)?

*Faculty and students, graduate students and honor's student*

- What types of projects do you think should be on ARC: Research, Test/Experimental Academic Applications (short -term), Grade-based Academic Applications (long-term), etc.?

*Experimental and grade based*

- List projects that you would like to see in ARC.

*SPSS, SAS capabilities*

- How do you think ARC should be funded, both now and in the future (E.g., Taxing externally funded projects, Pay-as-you-play (researcher will have to provide a funding line to use systems), Academic Affairs should provided some level of funding, etc.)

*Pay as you play*

- Given the current economic situation and potential for future budget cuts, how do you see ARC as far as campus priorities?

*Highest, good research gets us funds*

- Who do you see as the high-value customers/key stakeholders?

*Faculty*

- What difficulties do you think we will encounter satisfying users?

*Availability and level of competence by the provider*

- What timeline do you see for ARC?

*As soon as possible*

- How do you envision ARC serving the campus?

*ARC could serve academic research needs by providing research-level computing facilities, such as a multi-node cluster. I currently have to do all of my big calculations off-campus.*

- Who do you think should have access to ARC resources (research faculty only, all faculty, grad students, etc.)?

*Anyone at UNCW who has legitimate research computer needs.*

- What types of projects do you think should be on ARC: Research, Test/Experimental Academic Applications (short -term), Grade-based Academic Applications (long-term), etc.?

*Research!!! ACR stands for Academic Research Computing, doesn't it?*

- List projects that you would like to see in ARC.

*???*

- How do you think ARC should be funded, both now and in the future (E.g., Taxing externally funded projects, Pay-as-you-play (researcher will have to provide a funding line to use systems), Academic Affairs should provided some level of funding, etc.)

*Academic Affairs or ITSD should provide free accessto computing resources just as free access to library resources is provided.*

- Given the current economic situation and potential for future budget cuts, how do you see ARC as far as campus priorities?

*It is high on my list. Four or five years ago ITSD had \$500,000 in their proposed budget for high performance computing. It was almost funded by the legislature, being removed at the last minute. It has been ignored by UNCW since then.*

- Who do you see as the high-value customers/key stakeholders?

*Any faculty or student who uses or needs to use high-end computing in their research. There are three computational chemists in my department.*

- What difficulties do you think we will encounter satisfying users?

*Providing a large enough and fast enough computer.*

- What timeline do you see for ARC?

*That is impossible to say. I have seen no movement at all so far*

- How do you envision ARC serving the campus?

*1: Data storage 2: research environment including software installation, configuration and maintains 3: a platform for people to exchange technologies, ideas etc. 4. ARC should be able to provide some kind of testing bed like "soap box" so that individual can test ideas and applications without taking much resources or bothering others 5: volunteers can share some work.*

- Who do you think should have access to ARC resources (research faculty only, all faculty, grad students, etc.)?

*Every staff, faculty and grad students should be granted access after the request is filed and approved.*

- What types of projects do you think should be on ARC: Research, Test/Experimental Academic Applications (short-term), Grade-based Academic Applications (long-term), etc.?

*Research and Test/Experimental Academic applications first.*

- List projects that you would like to see in ARC.

*Sorry, I don't know much any existing projects.*

- How do you think ARC should be funded, both now and in the future (E.g., Taxing externally funded projects, Pay-as-you-play (researcher will have to provide a funding line to use systems), Academic Affairs should provided some level of funding, etc.)

*Depending on people's needs. Pay-as-you-play if you need something in high quality, otherwise it should not be charged.*

- Given the current economic situation and potential for future budget cuts, how do you see ARC as far as campus priorities?

*I do think this is very important for a research friendly campus. I understand that this takes a lot of efforts to build, but it shouldn't cost much since we have hardware on place and we can have some volunteer to do some work. If some projects take a lot of efforts to maintain and need high end service, they should have the capability to pay for the work.*

- Who do you see as the high-value customers/key stakeholders?

*Target on some early research initiatives first.*

- What difficulties do you think we will encounter satisfying users?

*1: user access level control 2: problems can not be solved in a timely manner due to the shortage of money and personals.*

- What timeline do you see for ARC?

*All I know is that it takes time to understand user's needs. Once ARC gets what needs to be done, it shouldn't take long to implement.*

- How do you envision ARC serving the campus?

*We MUST have better research computing support. It looks unprofessional when we use our federal grant funds to purchase basic items such as laptops, backups, etc! Right now we all do this, and we have got to fix it.*

- Who do you think should have access to ARC resources (research faculty only, all faculty, grad students, etc.)?

*Research faculty and graduate students with faculty supervision*

- What types of projects do you think should be on ARC: Research, Test/Experimental Academic Applications (short -term), Grade-based Academic Applications (long-term), etc.?

*Research!*

- List projects that you would like to see in ARC.

*Basic research computing support—first in a faculty lab/sandbox with dedicated technical staff, and later expanded to serve specific needs in storage and cycles. Backup/storage is also critical and should be centrally managed. We need to integrate with the library for data lifecycle management expertise.*

- How do you think ARC should be funded, both now and in the future (E.g., Taxing externally funded projects, Pay-as-you-play (researcher will have to provide a funding line to use systems), Academic Affairs should provided some level of funding, etc.)

*All of the above will be needed—basics will need to be paid from university accounts, and more serious and specific items from grant funds.*

- Given the current economic situation and potential for future budget cuts, how do you see ARC as far as campus priorities?

*We are soon going to start losing federal grant opportunities—and we are already at risk of audit for our data management policies. Is it going to take penalties to ensure change?*

- Who do you see as the high-value customers/key stakeholders?

*Research-active faculty who have large grant \$*

- What difficulties do you think we will encounter satisfying users?

*The severe need, people will want more that you can deliver*

- What timeline do you see for ARC?

*This is really urgent, but I am afraid we'll have to live through a disaster (major data loss or federal audit...) before we fix storage and data management support. It appears to be difficult to convey the urgency.*

- How do you envision ARC serving the campus?

*ARC should provide computing, storage, and technical assistance resources to the UNCW research community. This includes projects that are externally funded as well as internally funded.*

- Who do you think should have access to ARC resources (research faculty only, all faculty, grad students, etc.)?

*ARC should be available to research faculty and their graduate and undergraduate students. UNCW has a definition of “research active” faculty and perhaps that is a good definition to use.*

- What types of projects do you think should be on ARC: Research, Test/Experimental Academic Applications (short -term), Grade-based Academic Applications (long-term), etc.?

*Research projects (typically in the 3 to 5 year timeframe) and test/experimental applications (in the 1 to 3 year timeframe). Any applications that are “long-term” should be hosted on more stable production-level equipment.*

- List projects that you would like to see in ARC.

*Projects that have a need for (a) compute cycles, (b) large storage needs, and (c) those that require the hosting of advanced web databases with server-side programming.*

- How do you think ARC should be funded, both now and in the future (E.g., Taxing externally funded projects, Pay-as-you-play (researcher will have to provide a funding line to use systems), Academic Affairs should provided some level of funding, etc.)

*Baseline funds should be provided by AA, ITSD, and Research Administration. Research proposals should be asked to write in funds to support the center as well. Perhaps a template can be prepared that all grant proposals could use. Finally, internally funded projects could also provide some support in the way of internal departmental invoices.*

- Given the current economic situation and potential for future budget cuts, how do you see ARC as far as campus priorities?

*This is high priority b/c I believe cost savings are ultimately possible.*

- Who do you see as the high-value customers/key stakeholders?

*Research intensive departments: biology, chemistry, computer science, mathematics/statistics, etc.*

- What difficulties do you think we will encounter satisfying users?

*Getting them to pay for it!*

- What timeline do you see for ARC?

*I would like to see an official announcement by this summer or early Fall 2009.*

- How do you envision ARC serving the campus?

*Even though it is a great initiative, I believe it is not well known campus-wide. Most of ITSD services are mostly taken advantage of by the users that especially seek for that solution or service. However, if there was a better announcement system with continuous support and training to users, in my opinion the longevity and success of these services/projects would be more significant.*

- Who do you think should have access to ARC resources (research faculty only, all faculty, grad students, etc.)?

*I believe all the options listed should have access to these resources with priority given to research faculty, then all faculty and then grad students.*

- What types of projects do you think should be on ARC: Research, Test/Experimental Academic Applications (short-term), Grade-based Academic Applications (long-term), etc.?

*UNCW being an equal weight school, both research and teaching supporting applications are important. However, this committee's main task is to support research; therefore, research projects should be priority.*

- List projects that you would like to see in ARC.

*VM assigned to faculty for their storage needs and also for running applications that needs high computing power. Also, hosting software needed by faculty for research purposes as well as providing some training sessions for the interested faculty would be good potential projects for ARC. Another idea mentioned in the last meeting we had was to have in house people to help with data analysis needs of the faculty. The suggested idea was to have people that are experts in data analysis and econometric methods help faculty with the data analyses of their research.*

- How do you think ARC should be funded, both now and in the future (E.g., Taxing externally funded projects, Pay-as-you-play (researcher will have to provide a funding line to use systems), Academic Affairs should provided some level of funding, etc.)

*I am not very familiar with funding related issues on campus.*

- Given the current economic situation and potential for future budget cuts, how do you see ARC as far as campus priorities?

*With the current budget cuts, it seems that ARC may not be on the top of the priority list with its budget needs.*

- Who do you see as the high-value customers/key stakeholders?

*It would be faculty utilizing the ARC services.*

- What difficulties do you think we will encounter satisfying users?

*Letting users know of the services/support offered.*

- What timeline do you see for ARC?

*I am not sure what has been done. It is hard for me to say. However, the quicker it is implemented, the more research output per faculty would be highly likely. Given the increasing number of graduate programs offered at UNCW, increased number of publications per faculty would definitely have significantly positive impact on the perceived value and prestige of the university.*

Appendix C – Service Level Agreement

## Academic Research Computing Service Level Agreement

**Introduction**

It is the goal of Academic Research Computing (ARC) to provide a stable and secure environment for UNCW researchers while maintaining a freedom and openness that allows for customization of projects and modifications to those projects' systems running in the ARC environment.

In order to provide this environment it is important that all parties understand their roles in the installation and ongoing support of ARC-based systems. These commitments and relationships will continue to evolve as support resources change.

Each project that operates a system within the ARC environment must designate a liaison that will be the primary contact for the ARC staff. This contact is the responsible party for all aspects of the system.

**Project Title**


---

**Requestor/Liaison Information**

Name: \_\_\_\_\_ Phone: \_\_\_\_\_ Email: \_\_\_\_\_

**Additional Project Team Members**

Name: \_\_\_\_\_ Email: \_\_\_\_\_

Name: \_\_\_\_\_ Email: \_\_\_\_\_

Name: \_\_\_\_\_ Email: \_\_\_\_\_

**Terms**

Arbitration of disagreements will be handled by the liaison's supervisor and the Director of Operations and Systems Administration. Additional stipulations can/will be made on a per project basis.

ARC staff will:

- Physically house system(s)
- Advise on the setup and configuration of the system(s) for the project in order to meet university baseline requirements.
- Setup system(s) and install basic software.
- Will work with liaison to setup advanced software.
- Install security and maintenance patches for hardware and software.
- Send notification prior to installing security and maintenance patches.

- Work with liaison to troubleshoot problems with the system(s).
- Setup domain security groups as needed.
- Grant access to team members as requested by liaison.
- Develop a backup plan for system(s).

Liaison and team members will:

- Use system(s) in a responsible manner and in compliance with UNCW's Responsible Use of Electronic Resources policy found at [www.uncw.edu/itsd/documents/use.pdf](http://www.uncw.edu/itsd/documents/use.pdf)
- Communicate any problems to ARC staff.
- Be responsible for developing specialty software or code for projects.
- Avoid making changes to system(s) security configuration without first receiving approval from ARC staff.
- Work within the scope of the project as defined by the official project request with ARC and ITSD. Changes in scope should be communicated to ARC staff and should not be implemented without prior approval.
- Avoid any actions that could possibly jeopardize the stability or security of the UNCW computing environment.
- Conform to licensing for all hardware and software.
- Ensure that applications and data on the system(s) adhere to University policies, FERPA, HIPPA, IRB, Copyright, and all other applicable Federal and State laws.
- Maintain applicable maintenance contracts for products outside the scope of the baseline system(s).
- Be responsible for training additional team members.

### Signatures of Agreement

Liaison Signature: \_\_\_\_\_

ARC Staff Signature: \_\_\_\_\_

Print Name: \_\_\_\_\_

Print Name: \_\_\_\_\_

Title: \_\_\_\_\_

Title: \_\_\_\_\_

Department: \_\_\_\_\_

Date: \_\_\_\_\_

Date: \_\_\_\_\_

Name of system(s): \_\_\_\_\_

Appendix D - Code**Code – HTML Form for Project Request**

```

<form action="http://cgi2.uncw.edu/arc/request.php" ...
method="post"><br />
<table width="70%" border="0">
<tr>
<td width="35%"><label for="label">
<div align="right">Name:</div>
</label></td>
<td width="65%"><input type="text" id="name" name="name" /></td>
</tr>
<tr>
<td><label for="label">
<div align="right">Email:</div>
</label></td>
<td><input type="text" id="email" name="email" /></td>
</tr>
<tr>
<td><label for="label">
<div align="right">Phone:</div></label></td>
<td><input type="text" id="phone" name="phone" /></td>
</tr>
<tr>
<td><div align="right">Subject of Request:</div></td>
<td><input type="text" id="requestsubject" name="requestsubject" /></td>
</tr>
<tr>
<td>&nbsp;</td>
<td>&nbsp;</td>
</tr>
<tr>
<td><label for="label">
<div align="right">Your comments:</div>
</label></td>
<td>&nbsp;</td>
</tr>
<tr>
<td colspan="2"><textarea id="comments" name="comments" rows="10" cols="50"></textarea></td>
</tr>
<tr>
<td colspan="2"><div align="center">

```

```
<input type="submit" name="submit" value="Submit" class="button">
</div></td>
</tr>
</table>
<label for="name"></label>
<label for="email"></label>
<label for="topic"></label>
<label for="comments"></label>
</form>
```

**PHP script for Project Request**

```
<?php
// Variables and data from web post
$name = trim($_POST['name']);
$email = trim($_POST['email']);
$phone = trim($_POST['phone']);
$requestsubject = trim($_POST['requestsubject']);
$comments = trim($_POST['comments']);

//Error check user input
$datacheck = true;
if (trim($name)=="") $datacheck = false;
if (trim($email)=="") $datacheck = false;
if (trim($comments)=="") $datacheck = false;

if (!$datacheck)
{
    header("Location: http://www.uncw.edu/arc/requesterror.html");
    exit;
}

//Build the body of the message
$body = "";
$body .= "Name: ";
$body .= $name;
$body .= "\n";
$body .= "\n";
$body .= "Email: ";
$body .= $email;
$body .= "\n";
$body .= "\n";
$body .= "Phone: ";
$body .= $phone;
$body .= "\n";
$body .= "\n";
$body .= "Subject of Request: ";
$body .= $requestsubject;
$body .= "\n";
$body .= "\n";
$body .= "Comments: ";
$body .= "\n";
$body .= "\n";
$body .= $comments;
$body .= "\n";
```

```
// Build the email
$to = 'arc@uncw.edu';
$subject = "Request for Project: $requestsubject";
$message = "$body";
$headers = "From: $email";

// Send the mail
mail($to, $subject, $message, $headers);

// Redirect
header("Location: http://www.uncw.edu/arc/success.html");
?>
```


*Appendix E – Presentation Slides*

## Academic Research Computing



## What is ARC?

- Providing technical services, support, and expertise to faculty conducting research utilizing computing technology
- Transferring management of IT hardware and software
- Dedicated environment for IT-based research projects



## Importance of ARC

Better Research Facilities

↓

Better Researchers/Faculty

↓

Better Students/More Grants/Greater Acclaim

## What ARC means for Researchers

**Technology Overhead**

- Acquiring Technology Resources
- Specifying, Installing, Configuring
- Managing Technology Resources
- Backup, Security, Repair
- Project Specific Software Development

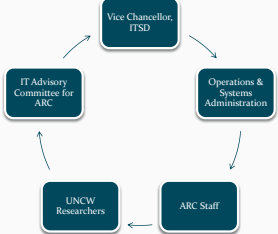
→

**Technology Overhead**

- Project Specific Software Development


Research

## ARC Organization



```

    graph TD
      VC[Vice Chancellor, ITS] --> IAC[IT Advisory Committee for ARC]
      VC --> OSA[Operations & Systems Administration]
      IAC --> UR[UNCW Researchers]
      OSA --> AS[ARC Staff]
      UR --> AS
  
```



## ARC at Other Schools



## Problems with ARC at Other Schools

- Lack of flexibility
- Little or no customization
- Long queues for access to systems
- Great if modeling, but what if...



## Changes in Flexibility

- Broader environments encompassing more fields
- “Personal” computers using virtualization
- Customized systems built for specific projects and tasks



## ARC Services

- Virtual Computers
- File Sharing
- Web Hosting
- Application Hosting
- Data Storage
- GIS Services
- Data Backup



## Who is Using ARC?

- Mathematics & Statistics Faculty
- Watson School of Education
  - Masters in Instructional Technology Program
  - Assistive Technology Demonstration and Lending Program
- School of Nursing



## How Can I Use ARC?

- Learning more about the program
  - Visit [www.uncw.edu/arc](http://www.uncw.edu/arc)
- Submit a Request for Proposal
  - [www.uncw.edu/arc/request.html](http://www.uncw.edu/arc/request.html)
- ARC Staff will contact you, discuss your project, and go from there...



## How Much Will ARC Cost?

- Each project is judged on a case-by-case basis
- Basic systems are provided by ITSD
- Projects which require increased data storage, processing power, or software licenses may require additional funding assistance from the requestor



## Who Can Use ARC?

- All projects will be research oriented and be led by a UNCW faculty member
- Access can be granted to UNCW Researchers, Faculty, Staff, Students upon request
- Off-campus researchers will have access to systems upon request



## Is My ARC System Secure?

- Systems are managed by ITSD
- Security and maintenance patches are installed in accordance with ITSD procedures
- Access to systems is limited by the faculty liaison to a project



## Is My ARC System Backed Up?

- Virtual systems are built in a "high-availability" environment
- Data can be backed up regularly and restored if needed



## Can I Keep My ARC System?

- Systems will stay online as long as needed, provided funding is available
- Once projects end, data can be backed up and systems re-tasked or destroyed



## Where Can I Get More Info?

- Visit the ARC website - [www.uncw.edu/arc](http://www.uncw.edu/arc)
- Contact the ARC Staff - [arc@uncw.edu](mailto:arc@uncw.edu)
- Talk to others who have used ARC
  - Visit [www.uncw.edu/arc/projects.html](http://www.uncw.edu/arc/projects.html)



Questions?

