Computing Status for the Department of Astronomy

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Introduction

The Department of Astronomy within the College of Liberal Arts and Sciences has a network consisting of multiple flavors of Unix-like operating systems and Windows. We have network connected devices on the University of Florida main campus and in remote locations connected through microwave transmitters. Our machines are used for mundane purposes such as word processing and email, as well as specialized uses such as data analysis and embedded applications.

Astronomy faces a tough task ahead. We have aging computer hardware, aging software configurations, and a poor network design. Additionally, within the past 24 months most “fixes” that have been made to problems with information technology have been temporary band-aids, and do not truly solve the problem.

This report discusses the department's computing and network infrastructure, plus staffing and budgetary issues. Although it would be impossible to fix all of these problems quickly, all of them can be corrected within 24 months; it will take time and support from the department and college to do so.

Computing Resources

The Department of Astronomy has approximately 170 devices connected to the Astronomy network in three different locations. These devices include network electronics gear, printers, general use computers, and specific application devices, such as the concam. The departmental IT staff are directly responsible for approximately 140 of these devices. The remaining devices are managed by other groups within the department.

Desktop PC's

The majority of the devices managed by the IT staff are Intel compatible x86 based "PC" computers. Most of the PCs run a version of the Linux operating system but, approximately 40 machines run Microsoft Windows. The PC's in the department are used for a wide variety of purposes ranging from data analysis and programming, to email and web-browsing.

The Linux hosts are used primarily for programming, data analysis, email, and other common tasks. Their operating system is any of many different versions of RedHat Linux, including 6.0, 6.1, 6.2, 7.0, 7.1, 7.2, and 7.3. Many of these machines are also used as "NFS Servers" to provide home directory space for users within the department.

Because Linux and other Unix-like operating systems are targeted for exploitation by "script kiddies," it is important to keep these hosts up to date with their vendor supplied security patches. Supporting 7 versions of Linux makes this task difficult at best. Further, RedHat no longer supports version 6.0 and 6.1 of their operating system.

There is a tool called "Kickstart" that can be used with RedHat Linux to provide rapid deployment of a customized RedHat configuration. We should settle on a version of RedHat Linux as our standard version, setup and configure a Kickstart server, and re-image the Linux workstations within the department to bring them up to the new standard. Once the machines are re-imaged with the new operating system, a nightly event can be run to keep the workstations up to date with patches and software packages that we select to be installed on these units.

The Windows machines are used in the teaching lab, by the office staff, and some faculty offices. They run Windows 95, 98, NT, and 2000. Most of them are primarily used for word processing, web-browsing, and electronic mail. Microsoft provides periodic service packs for their operating systems, and makes them available through the Windows Update Utility.

The biggest problem that Astronomy faces with the Intel based PC's is that the majority of them have either exceeded their service life cycle or are rapidly approaching the end of their life cycle. The Gartner Group recommends a maximum PC service life cycle of three years for "power users" and a life cycle of up to four years for low-end users[1]. The Linux users are the more computationally intensive users within the department, but on the average they have the oldest machines.

Several of the PC's are older than four years and it is difficult, if not impossible, to maintain and support them. Although it is possible to replace several of the internal components, in the long term it would be more cost effective to replace aging machines that have exceeded their life cycle rather than to try and cobble together bits and pieces to keep them running.

The department needs to establish a recurring annual budget to rotate PC's within a four year life cycle. As new machines are brought into the department, machines that are within their four year life cycle can be moved to users that do not have such strict computational needs. However, Astronomy is already behind and has over 25 PC's in use that have exceeded their life cycle. Many of these machines are experiencing hardware failures, including power supply failures, video card failures, and hard disk failure.

Printers

The department has one color printer and several black and white laser printers in various locations within SSRB. However, they are not strategically placed to provide the best support for our users. Ideally there should be at least one printer on each floor that all of the users will have access to, and the best printers should be placed where they are most needed to handle the higher loads. Additionally, there have been recent problems with the fourth floor printer and we should remove it from service and either get it repaired, or replaced.

In order to provide the best support for the departmental users, we should make the following changes to the printer locations:

1. Move the LJ-4M from 221 to the 4th floor when the space for the grad students has been rennovated
2. Move the LJ-4000 from 318 to 221
3. Move the LJ-4 from 211-C down to the basement in room 11
4. Take the LJ-4Mplus from the fourth floor and either repair, or replace it

1 Gartner Group.
Desktop PC life: Four years for the mainstream.
www.techrepublic.com/article_guest.jhtml?id=r00320011219ern01.htm

These changes will allow us to upgrade the LJ-5 in 221, add a printer on the fourth floor, and provide printing for the users in the basement.

Servers

The IT staff within the department of Astronomy maintain three linux servers and three solaris servers. These servers provide centralized file storage, email, web-access, and application support.

Terra

Terra is the primary departmental NFS server. It is a Dell Optiplex GX-100 desktop machine that had been thrown into the task of being a centralized location for file storage. There are three notable problems with terra:

1. Terra does not have adequate disk space to sufficiently support all of the departmental space needs.

   Due to the lack of space, many user home directories are spread out among different linux workstations within the department. Because these home directories are spread throughout the department, they are not adequately backed up, and if the host machine goes down they become unavailable. Recent power outages within the Bryant Space Science Research Building have required the departmental IT staff to visit each linux host within the department to make sure it is up, so that users may access their home directories and continue their work.

   Besides home data, users within the department have research data which is scattered throughout the network. It is not uncommon to find research groups storing all of their data on several different hosts within the department.

2. Terra is not a “server class” machine, and as such has many failure points. A true “server class” machine should have redundant power supplies and redundant disk, as well as adequate storage capabilities to meet the departmental needs.

3. Several users are in the habit of using the CDR/W writer on Terra to burn CD's of their work and other data. General users should not be using the departmental NFS server to create CD's.

The department should replace Terra with a new server that has redundant power and redundant disk with enough storage capacity to provide a centralized location for all of the users home directory data as well as their research data. The current Terra chassis should be made available as a public use workstation for users within the department that need to use the CDR/W.

An adequate 1U replacement chassis from Dell can be purchased for $2500, and an external disk array that will provide nearly a terabyte of storage with redundant power supplies and RAID 5 capabilities with a hot spare can be purchased for approximately $5000.

If the department can not afford to fund the disk storage outright, it may be possible to get individual research groups to purchase slices of disk space from the new terra with the understanding that the disk space would be backed up, reliable, and available.

Polaris

Polaris is the departmental mail & mail storage server, web-server, NIS master, and login server. Polaris also runs the IDL license manager. It is the only machine that is managed by the departmental IT staff that is accessable from outside of the Astronomy network.

Polaris is a Gateway E-3400 desktop machine. The main problems with polaris are that it is not a real server chassis and it is underpowered to adequately support all of the services that are loaded onto it. A replacement Dell server chassis can be purchased for $2500. The login, web, and mail services should also be migrated to a different chassis to isolate the sets of services. With the services migrated to a new chassis, the existing Gateway machine can be returned to general use as a workstation within the department.

Helios

Helios is a machine based on the alpha processor, running RedHat Linux 6.1. Helios should be used primarily for data processing.

Because Compaq has announced an end of life for the Alpha processor, getting hardware support for this machine may be difficult in the long term. However, the machine has enough memory and processing power that it should be able to be used for data processing without any problems as long as the necessary software is available.

Once we have settled on a single version of Linux to support, we should rebuild Helios with that version, and update all of its binary and library files.

Taurus

Taurus is a Sparc 5 running Solaris 2.6. It is the primary machine which is used to run “The Publisher” desktop software package. Taurus also provides applications for the three Solaris machines in Dr. Sarajedini's group through NFS.

Taurus is eight years old, and it is only a matter of time before the hardware

will fail. The NFS distributed applications can be moved to Terra from Taurus, without any interruption in service for the Sun users.

However, trying to maintain The Publisher over a long term period of time will be difficult. ArborText, the manufacturer of The Publisher, quit selling the package in 1996, and quit supporting the package in 1998. A sales person at ArborText explained that their current product offerings do not read The Publisher files natively, but that they could add compatibility into their current package for a fee. The hardware that The Publisher is running on is very old, and The Publisher will not run on newer versions of the Solaris operating system.

Assuming that the cost for the customized version of the current ArborText offering is prohibitively expensive, another solution should be found. According to the documentation, The Publisher provides a method to manually convert its propietary format into both sgml and LaTeX formats. It might be possible, although time consuming, to convert The Publisher documents to LaTeX. Converting The Publisher documents to sgml and LaTeX, and moving the users of The Publisher to a comparable software package should be a priority.

Micron
Micron is a Sparc 5 running Solaris 2.5.1. There is no documentation as to what its purpose is, and we do not know the root password. Micron poses a risk to the departmental network because we can not apply vendor supplied service packs.

For the immediate time being, we have removed Micron from the departmental network. When the services it provides have been identified, we can migrate those services to another host.

Urania
Urania is a Sparc 20 running Solaris 2.5 (SunOS 5.5). It provides file storage for Dr. Lada.

The hardware that runs Urania is eight years old, and Sun Microsystems no longer supports Solaris 2.5. We should move Dr. Lada's data and home directories onto a new centralized file server and decommission Urania.

Recommendations
We should move Terra and Polaris to new server chassis. We should bring up a third PC server chassis and move many of Polaris' functions to it in an effort to alleviate the load on Polaris. Ideally the new Terra chassis would be dedicated to NFS and SMB file sharing only, and not even allow user login. The Polaris chassis would simply be a login, and mail. The third PC server

would be the NIS master server, license metering server, and web server.

We should migrate away from The Publisher and shut down Taurus. We should migrate the data from Urania and shut down Urania.

Network Resources

The Department of Astronomy has a network infrastructure spanning the five floors of the Bryant Space Science Research Building, and two remote locations fed through a microwave transmitter located in Yon Hall.

SSRB Network

The Astronomy network within the Bryant Space Science Research Building consists of twisted pair and coaxial network cabling and equipment.

Twisted Pair

Each room within the department has two twisted-pair network drops which run back to the second floor communications closet in room 209. Inside of the second floor closet are the network electronics (switches) which provide the departmental network backbone.

Additional workgroup switches have been deployed in individual rooms to make extra drops available as needed.

In the future, all new network drops, such as those recently installed by departmental IT staff in the basement, should return to the communications closet on that floor. CIRCA is willing to donate switched network electronics which we can install in the communications closet of each floor to drive any new network drops.

Long term, we should investigate upgrading the departmental network infrastructure. Such upgrades would include providing a fiber-optic backbone between each of the floors in SSRB, and moving the network switches to the floors they serve.

Coaxial

There are three runs of coaxial ethernet cable in the department. One is used to feed a printer on the 3rd floor, another is used to feed a printer in 211-C, and the purpose of the last run has not been identified. We should move these printers away from coaxial cable to twisted pair, and disable the coaxial network.

Rosemary Hill & The Radio Observatory

The Rosemary Hill Observatory is located approximately 35 miles from the University of Florida Campus outside of the town of Bronson. The Radio Observatory is located an additional 20 miles from Rosemary Hill outside of Oldtown. Both locations have network connectivity to provide access to the

devices located there.

The Rosemary Hill Observatory is connected to the UF Campus network through a line of sight microwave transmitter located on top of Ben Hill Griffin Stadium. At the end-point, a fiber optic link carries the network signal to the observatory. An additional repeater carries the signal from Rosemary Hill into Chiefland, where it is then sent on to the Radio Observatory in Oldtown.

The wireless link is managed by Network-Services. It is an 802.11b type wireless connection and has a 5-mbit useable data throughput. All data over the wireless link is unencrypted, and because the wireless connection is on the same VLAN as the Astronomy network, all broadcast traffic within SSRB is broadcast over the wireless link thus consuming bandwidth.

My recommendation regarding the wireless connection is to move it onto a different network in an effort to localize all traffic. Network-Services has already proposed this idea to the department, and has made all of the provisions necessary and are waiting for us to proceed.

Network Protocols

The Astronomy network is fed the IP, IPX, and Appletalk protocols from the Network-Services network connection in room 209.

IP is the "native tongue" of the internet. All of the networked computers within the department need IP.

IPX is the protocol used by Novell NetWare servers. Because newer versions of NetWare can speak IP and the department has no NetWare services, we should request from Network-Services that this protocol can be disabled.

Appletalk is used by older MacIntosh machines. Because modern versions of the Mac operating systems can speak to Appletalk devices over IP, we should request from Network-Services that this protocol be disabled.

IP Address Allocation and Filters

Each machine in Astronomy is assigned a unique IP address. IP addresses take the form of *1.2.3.4* with each number being an 8-bit number. Network-Services provides both "public" and "private" IP addresses to all units on campus that need the IP protocol.

Public IP Addresses

A public IP address is an IP address that is routed on the internet. This means that any machine with a public IP address can be seen by any other

device connected to the internet. Because public IP addresses are routed on the internet, there is a limited number of addresses available. Although UF has a fairly large number of public IP addresses, the numbers are not effectively managed and therefore a large majority of UF's public IP space goes unused, or underutilized.

Astronomy has been allocated 253 public IP addresses by Network-Services. Currently, all devices located on the Astronomy network, with the exception of a few devices in the IRLAB, use public IP addresses. Each host is manually configured for its unique IP address.

Private IP Addresses
A private IP address is not routed on the internet. This means that although it can access any device within its own network, it can not be remotely accessed without going through some other gateway device.

Network-Services allows private IP addresses to access other devices on the internet through IP Network Address Translation. Any host configured for private IP would be able to do most of the functions needed for daily internet use, including web, sending of email, ftp, etc.

Astronomy has been allocated 253 private IP addresses. Because private IP addresses are not routed, it would be simple to gain more private IP addresses.

Network Filters
Network filters block or allow access to machines on a network based on the service, origin, and destination of the request. Network-Services currently blocks remote access to all hosts within Astronomy with an IP address less than 128.227.184.224, with the exception of polaris, through their router.

Unfortunately, if the Network-Services filters disappear, then all hosts on our network will be remotely accessable. This creates the risk that any host on our network could be cracked into by a malicious attacker on the internet if the filters go down.

Static IP Addressing -vs- DHCP
There are two common ways to assign IP addresses to hosts on the internet, static addressing and DHCP.

The method that Astronomy currently uses is to manually configure each host for its unique address. The disadvantages to this approach include: any changes in network topology require modification of each host on the network, a seperate table must be maintained for each hosts IP address, if a machine is misconfigured it could accidently knock another machine off the network, etc.

The DHCP protocol allows each workstation to receive its unique IP address from a central DHCP server. DHCP is advantageous in that it addresses all of the negative aspects of static IP addressing, while at the same time allowing administrators to reconfigure the networking configuration of workstations with ease.

Recommendation
My recommendations regarding our IP addressing are the following:

1. Move all workstations from public IP to private IP. This will give an extra level of protection from off-campus crackers in the event that the network filters disappear. Any host that needs to be remotely accessable can be given a public IP address, but in most cases departmental users will continue to login through a managed portal server.
2. As the operating system of each machine is reinstalled, the machine should be moved to DHCP addressing.
3. Long-term, once the move to private IP has been completed, we should give back half of our public IP space to Network-Services. Giving back some of our unused IP space is good for the campus.

Network-Services Takeover
There have been many discussions over the years of having Network-Services manage all network infrastructure on campus 'to the face plate.' The concept is that a centralized organization will be able to provide better service to all organizations than the individual organizations will be able to provide themselves. The stated goal is to save manpower and costs by avoiding duplicity of effort among each unit within the campus.

Network-Services has recently started managing the networks for a few different organizations on campus as part of a pilot-project to verify the feasibility of managing all network-resources to the faceplate. The sites that are participating in the pilot project have turned over all network infrastructure, including the physical wiring and network electronics, to Network-Services. In exchange for turning over the infrastructure, Network-Services is providing a valuation on the equipment, and giving the individual site a credit towards their network management costs.

Organizations that have poor, or aging, infrastructure, will have to pay to bring their infrastructure up to Network-Services specifications. This will undoubtably include replacement of network electronics plus rewiring of the physical infrastructure.

Eventually, once the pilot-projects are completed, Network-Services will begin taking over network infrastructure unit by unit. Once this happens,

there will be a monthly service charge assessed for each network port, plus most likely a setup fee.

Currently, Network-Services is unsure of how much their service will cost organizations. Because they are just starting the pilot projects, they have not been able to adequately determine their costs, and so have been unable to provide me with numbers as to how much this service will cost. However, the Health Science Center at the University of Florida has had their network infrastructure centrally managed for some time, and their fees are available to give us a base line.

Health-Net charges units located within the Health Science Center both a monthly usage fee, and an activation fee. The usage fee is $12 per month per network port, and the activation fee is roughly $140 per port. Additionally, Health-Net does not allow individual users to extend their network port density by plugging mini-workgroup hubs or switches into the network; instead they expect their users to purchase additional network drops.

If the Network-Services fees for network access are comparable to Health-Net's fees, then if Network-Services takes control of our infrastructure we will have a recurring charge of roughly $27,000 per year. Although we would most likely be able to receive a discount, or preferential treatment, from Network-Services, it is my opinion that we should wait to turn our infrastructure over to Network-Services because the initial costs, and recurring costs, would be too much to bear for the department at this time. In the interim, we should continue to foster good relations with Network-Services and work closely with them, while upgrading our internal network infrastructure to meet campus standards.

Departmental IT Staff

The Department of Astronomy currently has 1.5 FTE consisting of one full time A&P staff member, and one part time Technical OPS staff member. For the past few months the OPS staff member has been working as a 1.0 FTE, but the line is only funded through the beginning of December.

During the previous month I have been able to make observations on the workload that the departmental IT staff face on a daily basis. Because of the condition of many of the PC's within the department, and the state that the departmental IT resources are in, the IT staff are kept busy during a normal forty hour work week. When special projects arise, such as space relocation, the departmental IT staff are left with one or two days of “triage mode” in an effort to catch up with the job queue.

An informal survey of other units on campus shows an average of one FTE per 60 machines, with the lowest FTE to computer ratio at 1 FTE per 46 machines, and the highest at 1 FTE per 85 machines. In comparison, Astronomy has approximately 1 FTE per 93 machines supported.

With the exception of the College of Health and Human Performance, the other organizations surveyed were not responsible for all of the services that the Astronomy IT staff supports; notably the physical network infrastructure. Additionally, the other units have standardized hardware and software configurations which simplifies the support burden.

Considering that departmental IT staff have the extra task of supporting network infrastructure, and the existing state that the departmental computing resources are in, Astronomy should increase the IT staff funding to provide a total of two FTE. Preferably, this would be done by converting the OPS line to a USPS line. This position should be a Systems Programmer or Senior Computer Support Specialist.

Documentation and Training

Proper documentation should take two forms. The first form is internal documentation, which provides information on operating system, hardware, and application installation, network diagrams, and other reference material for the system administrators. The second form, external or end-user documentation, is documentation that can be given to users explaining how to accomplish tasks, use applications, request an account, etc. Training refers to both training and enrichment for the system administration staff, as well as training for end users on the use of the systems.

Documentation

There is currently no internal or end-user documentation that I have been able to find. We should develop documentation for our users explaining things such as how to change a password, how to access mail remotely, what applications are available, what printers are available, etc. The documentation should be made available through a departmental computing web-page that will be created.

We have begun to create internal documentation on new application installations, departmental inventory, and other aspects of the Astronomy network, but we are still missing a lot of information on existing configuration and design choices. Eventually, all of our internal documentation will be available through a password protected folder from the departmental computing page.

Training

As new users come into the department, we should provide basic training to them explaining how to login to the system, access their email, and some basic information on the applications we support.

These training programs could be conducted at the beginning of each semester, and coordinated so that all of the new faculty, staff, and grad students may attend.

The IT staff should also be given the opportunity to seek additional training. As technology changes, IT staff have to constantly keep up to date on security patches, new software versions, new hardware, etc. It is also beneficial to take a look at how other locations are trying to meet the same goals, and adopt the solutions that work.

Some of this information can be gained by staying current with periodicals

and technical email lists, however training conferences can be an immensly valuable source of information as well. We should make a provision in the budget so that each of the departmental IT staff can gain additional training that is relevant to supporting the needs of the department by attending a conference each year.

Budget

Astronomy needs to establish an annual budget for computing. This budget should include computer replacement, annual software licenses, training, and infrastructure upgrades.

An annual budget for information technology in the department would be close to $50,000 annually. The breakdown is roughly $37,500 for hardware (server and desktop), $5,000 for software, $3000 for training, $1500 for network infrastructure upgrades, and $3000 for miscellaneous consumables.

Below is an estimated annual budget for the departmental IT needs. It does not include special purchases, such as new printers.

Item	***Quantity***	***Unit cost***	***Amount***
Replacement PC	20 - 25	$1,250.00	$25000.00 - $31500.00
Server depreciation	Annual depreciation	$5,000.00	$5,000.00
Sun Scholarpac Software License *	7	$150 buy-in, $24 per license	$318.00
Maple *	6	$50.40	$302.40
Matlab *	unlimited	$375.00	$375.00
CSLG (DEC Alpha software license) *	1	$60.00	$60.00
X-Win32 Software *	unlimited	$360.00	$360.00
Autocad (irlab) *	2	$200.00	$400.00
Star Office Support Maintenance Contract *	1	$100.00	$100.00
IDL Maintenance Contract **	1	$2,000.00	$2,000.00
Network Infrastructure	Depreciation and Upgrades	$1,500.00	$1,500.00
Staff Training	2 conferences (1 per staff member)	$1,500.00	$3,000.00
Miscellaneous			$3,000.00
Total:			***$41741.40 - $47,891.40***

* These licenses are paid for through the UF Soda Shoppe
** The IDL license maintenance agreement is paid to RSI and due in September.

Action Plan

The action plan is a proposal on how to proceed within Astronomy to correct the existing problems, and plan for the future.

Server Phase
The server phase of the action plan involves replacing the existing “servers”, consolidating file storage, and shutting off un-necessary servers. The replacement chassis are critical to complete the entire system upgrade.

1. Purchase 3 new Dell server chassis, a UPS capable of supporting them, and a Promise Technology RM-8000 external disk array populated to provide a terrabyte of storage. These chassis will replace Terra and Polaris, provide the ability to consolidate file storage, and offload many of the services from the Polaris onto a new server giving us better reliability. Estimated cost is $18,000.
2. Consolidate home and data directory space on the new NFS server.
3. Configure a kickstart server to rapidly deploy our standard configuration of RedHat Linux.
4. Convert The Publisher documents to LaTeX and decomission Taurus.
5. Migrate the data from Urania to the new file server and turn it off.
6. Take the old “Taurus” chassis and make it a public access machine available for burning CD's.

Workstation Phase
The workstation phase involves reformatting each Linux workstation in the department and replacing aging hardware. This phase of the 'action plan' will continue as we will have to phase out old PC hardware annually.

1. Confirm and complete departmental hardware inventory.
2. Install new versions of the operating system on existing workstations using the kickstart service.
3. Convert the new workstations to DHCP for IP address resolution.
4. Replace 20-25 aging workstations. Estimated cost is $31,500.

Network Infrastructure
This phase will ensure that any new network drops follow campus standards, while at the same time providing us the ability to return a portion of our public IP space back to Network-Services.

1. Move all workstations to private IP.
2. Install a fiberoptic building riser between all floors within SSRB.

Estimated cost is $5,000.00.

3. Any new network drops will be terminated in the local communications closet rather than having them terminated in room 209.
4. Have Network-Services quit routing the IPX and Appletalk protocols to our network.
5. Reconfigure the devices at Rosemary Hill and the Radio Observatory and have Network-Services move the wireless link onto a different network.
6. Develop documentation on our building infrastructure.

Documentation and Training

Documentation is task that will continue as we update and install new software, provide new services, or disable old services.

1. Develop a computing center web-site. Provide end-user documentation for common tasks, such as logging into the network or checking email.
2. Develop and implement training program for new users.
3. Develop documentation for any product installation or server configuration we setup for future internal reference.

Staffing

Between the daily tasks that the Astronomy IT staff face, and the repairs we must do to the system, we need two full time staff members. We should convert the part-time OPS line into a full-time USPS line.

Appendix A: Workstation Inventory for Astronomy*

Name	*Location*	*Purchase Date*	*Decal #*	*OS*
Polaris	221	1/2001	4910-AA-164880	RedHat 7.0
Terra	221	12/2000	4910-AA-163722	RedHat 7.2
Canary	426	3/2000	4910-AA-158475	Win98
Tuna	426	1/2000	4910-AA-157516	Win98
Ole	422	8/2001	4910-AA-169512	RedHat 7.1
Poliahu	418	1/1999	4910-AA-150687	Win2k
Generic	416	2/1997	4910-AA-138074	NT
Cetus	416	10/1998	4910-AA-149001	RedHat 6.0
Waipio	414	Laptop personal? (Telesco)	(check)	Win2k
Cryo	404	9/1999	4910-AA-155698	Win98
Ircad	404	11/2001	4910-AA-170617	Win2k
Voyager	304	10/1996	4910-AA-136513	Win98
Ufro2	304	11/1999	4910-AA-156406	Win2k
Ufro1	302	1999	4910-AA-155244	Win2k
Dell1	302			
Dell2	302			
Quasar	302	1/1999	4910-AA-150685	Win98
Icarus	310	8/1999	4910-AA-155225	RedHat 6.0
Hydra	310	11/1999	4910-AA-156408	RedHat 7.2
Iras	312	11/1996	4910-AA-136839	RedHat 6.0
Numfar	312	8/2001	4910-AA-169514	Solaris 8
Lane	314	1/1999	4910-AA-150684	RedHat 6.0
Draco	318	7/2000	4910-AA-160568	RedHat 6.2
Bohr	316	6/2000	4910-AA-159273	RedHat 7.2
Dorado	318	10/1999	4910-AA-156184	RedHat 6.0
Waltz	320	10/2000	4910-AA-162055	RedHat 7.2
Tango	320	10/1999	4910-AA-156181	RedHat 6.0
Rigel	322	1/2001	4910-AA-164881	RedHat 7.0
Kepler	324	7/1998	4910-AA-146761	RedHat 6.0
Ritesh	319	5/1998	???? (Dell Decal: EV1SL)	Win98
PC1-319				
PC2-319				

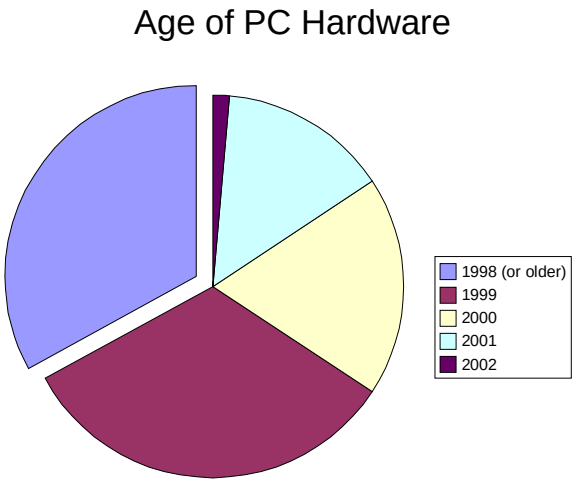
Name	*Location*	*Purchase Date*	*Decal #*	*OS*
Bobo **	205	4/1997 & 2002	4910-AA-138873	RedHat 7.3
Janksy	207	7/1998	4910-AA-146760	RedHat 6.0
Bell	207	5/1997	4910-AA-138968	RedHat 6.0
Saturn	211-A	1/1999	4910-AA-150682	RedHat 6.0
Miranda	211	6/1998	4910-AA-145878	Win2k
Neptune	211-B	5/2000	4910-AA-158611	Win2k
Venus	211	4/2000	4910-AA-158592	Win2k
Generic	211-C	1997	No decal	Win98
Newjpo	211-D	2001 or 2002	none	Win98
Rm211D	211-D	10/1999	4910-AA-156182	Win98
Jupiter2	211-E	6/2000	None visible	Win2k
Mars	211-E	6/2000	4910-AA-159271	Win2k
Twist	210	10/1999	4910-AA-155857	RedHat 6.0
Hewish	212	6/2000	4910-AA-159272	RedHat 6.2
Spica	214	10/1999	4910-AA-156183	Win98
Annapuma	216	1/2001	4910-AA-164879	RedHat 7.1
Lebo	213	7/1998	4910-AA-146763	Win95
Cassini	215	1/1999	4910-AA-150681	RedHat 6.0
Pegasus	215	8/2000	4910-AA-161686	RedHat 7.2
Anqet	215	10/1998	4910-AA-149003	RedHat 6.0
Isis	215	10/1998	4910-AA-149000	RedHat 6.0
Cassiopeia	220	5/1997	4910-AA-138972	Win95
Orion	220	11/1999	4910-AA-156407	RedHat 6.0
Meteor	224	1/1999	4910-AA-150683	Win2k
Mira	3C	7/1998	4910-AA-146762	RedHat 6.0
Phobos	309	8/1999	4910-AA-155220	RedHat 6.0
Europa	309	8/1999	4910-AA-155222	RedHat 6.0
Callisto	309	8/1999	4910-AA-155224	RedHat 6.0
Win2k Machine	3	6/1997	4910-AA-143212	Win2k
Ganymede	309	8/1999	4910-AA-155221	RedHat 6.0
Titan	309	8/1999	4910-AA-155219	RedHat 6.0
Giralda	3	Unknown	None (Guzman)	RedHat 6.0
Oberon	309	6/1999	4910-AA-154239	RedHat 6.0
Charon	309-A	8/1999	4910-AA-155223	RedHat 6.0
Osiris	3C	6/1997	4910-AA-139729	RedHat 6.0
Pam	1	12/1996	4910-AA-137117	Win95

Name	*Location*	*Purchase Date*	*Decal #*	*OS*
Leiden ***	1	5/1992	4910-AA-115253	AIX
Unknown ***	1	10/1992	4910-AA-117774	AIX
Mercury ***	1A	8/1996	4910-AA-135279	Digital Unix
Rscvn	11	6/1997	4910-AA-139800	Win98
Ast4722a	11	5/1997	4910-AA-138969	Win98
Cardcat	11-A	Unknown	None Visible	OS/2
Lumen	12	11/1999	4910-AA-156410	RedHat 6.0
Optica2	12	1/2001	4910-AA-164882	NT
Bessel	14	1/1999	4910-AA-150686	RedHat 6.1
Celsius	14	8/1996	4910-AA-135724	RedHat 6.0
Pluto	221	5/1997	4910-AA-138970	RedHat 6.0
SSRB Daycam	401	5/1996	4910-AA-133667	Win95
Unplugged	413	6/1997	4910-AA-143211	N/a
Max	413	12/2000	4910-AA-163727	Win2k
Dead Machine	11	1/1996	4910-AA-132427	Win95
Galileo	309A	2001	None	RedHat 7.1
Chewbacca	221A	1/2000	4910-AA-157515	RedHat 6.1
Valhalla	221A	1/2001	4910-AA-164877	RedHat 7.1
Cosmo	221A	1/2001	4910-AA-164883	RedHat 7.1
Taurus ****	221			Solaris 2.5
Micro ****	221			Solaris 2.5
Unknown ****	221			Solaris 2.5
Unknown ****	221B			Tru64

- * This inventory is restricted to equipment that is owned by the department, but ***does not include*** equipment in the teaching lab, or equipment owned by the Irlab.
- ** Although the 'bobo' chassis was purchased in 1997, in May 2002 it had a motherboard and hard-disk replacement.
- *** The unix workstations in rooms 1 and 1A appear to be functional, and the unit in 1A is in use. However, it is unlikely we would be able to get replacement parts for these units, or service on these units, and a solution that could replace their functionality should be investigated.
- **** Taurus is still in use to support 'The Publisher'. Micro and (tba) are both currently turned off. The purpose of (tba2) has not yet been determined.

Appendix B: Summary Age of PC Hardware*

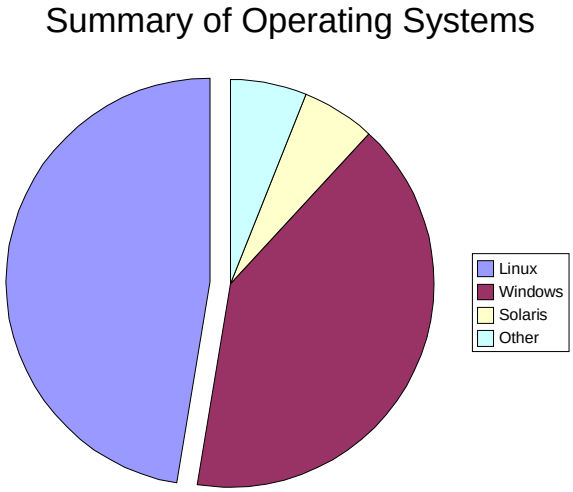
Year Acquired	*In Inventory*
1998 (or older)	25
1999	25
2000	14
2001	11
2002	1



- The summary age of PC Hardware only covers Intel or AMD based “PC” hardware listed in the above inventory.

Appendix C: Operating System Distribution*

Operating System	*Number*
Linux	48
Windows	41
Solaris	6
Other	6



* The summary only includes machines that the departmental IT staff directly support, and do not include machines located in the Irlab. Additionally, there are approximately 10 additional machines that need to be included in the inventory.

Appendix D: Network Printers

Name	*Model*	*Location*	*Decal*	*Acquired*
Thirdfloor	HP LJ-4000	318	4910-AA-149430	11/1998
Chair	HP LJ-5M	211-A	4910-AA-136104	9/1996
Admin	HP LJ-4000	211	4910-AA-142574	4/2000
Office	HP LJ-4Mplus	211-C	4910-AA-125799	8/1994
Lada	HP LJ-4Mplus	220	None (personal?)	~1994
Dept	HP LJ-8100DN	309A	4910-AA-158344	3/2000
irlab	HP LJ4Mplus	405		
Color		211-E		

Appendix E: Applications

Application	*Location*	*Version*	*OS*
Starlink	ole:/data/ole0/software/star-lnx	??	Linux
Heasoft	terra:/software/lheasoft	5	Linux
Chandra Interactive Analysis	terra:/software/ciao	1.1 (12/1999)	Linux
Maple	terra:/software/maple	6	Linux
miriad	polaris:/software/miriad	00aug11	Linux
Aips++	hewish:/data/hewish0/depot/aips++	1.4 (391)	Linux
Exam (home built)	polaris:/software/exam		Linux
Star Office	terra:/software/soffice	5.2	Linux
Star Office	terra:/software/staroffice6.0	6.0 Beta	Linux
GILDAS	polaris:/software/gildas	2	Linux
unipops	polaris:/software/unipops	3.5	SunOS
matlab	polaris:/software/matlab	8	Linux & Solaris
redhat	terra:/software/redhat	7.2	Linux
mathcad	polaris:/software/mathcad31	3.1	Linux
Mathematica (old)	terra:/software/matica	2.1	Solaris
Iraf	terra:/software/iraf	2.11 rev. 3	Linux & Solaris
aips	jansky:/data/jansky0/depot/aips	10/15/99	Linux
The Publisher	saturn:/software/pub3.2.2	V3.2.2	Sparc
idl	polaris:/software/rsi	5.4	Sparc & Linux
Island Software Suite	terra:/software/island40	4	Sparc
Java Runtime	terra:/software/jdk	1.31	Sparc & Linux
JCMT Tool	terra:/software/ompot	1	Java Based

Please note, some of the software packages used have annual renewable license fees, such as with IDL.

Appendix F: IT Staffing Survey

Organization	*FTE*	*Computers Supported*	*FTE:PC Ratio*
College of Health Professions	7.5	350	1:46.6
College of Design, Construction, and Planning	5	250	1:50
Department of Mathematics	1.5	120	1:80
College of Health and Human Performance	3.5	300	1:85