Computing Infrastructure and Policies

Department of Computer Science – University of Virginia

Introduction

The Department of Computer Science (CS) maintains an extensive computing infrastructure consisting of a network, desktop computing, remote desktop computing, department wide storage, backup facility, batch computing facility, and an interactive server computing environment. This infrastructure supports undergraduate and graduate lecture and lab courses, graduate student research, and faculty research.

Equipment Locations

The Department's central computing infrastructure is located in three computer centers, Rice Hall rooms 003, 374, and 574. Room 003 is the main computer center housing critical servers, storage, and large computing systems, and is served by 80 tons of air handlers, 1,600 KVa of utility power, and 80 KVa of UPS power. This room has logged keycard controlled access, only granted to system staff and select faculty. Rooms 374 and 574 contain equipment that also requires logged keycard controlled access, but access is granted to faculty and students with a need to physically access the equipment. Each floor of Rice Hall has a logged keycard controlled access network closet, and Olsson Hall 016 (key access) also holds a CS Dept. network switch.

Equipment inventory and staging is located in Rice Hall room 007. Equipment is received, assembled, and configured in this room. This room also has logged keycard controlled access, only granted to system staff.

Networks

The Department deploys and administers a wired network which connects desktop computers to switches on each floor. These switches are then connected to a building 'core' switch in Rice Hall room 075 via 10Gb downlinks.

In the main data center, Rice Hall room 003, racks of servers are connected to Top of Rack (TOR) switches, and each TOR is connected to a Row Aggregation (RAG) switch. Each RAG is then uplinked to a core data center switch at 10Gb. The data center core switch is connected to the building core at 40Gb.

The building core switch is linked to the UVA main switching network via a 10Gb uplink, providing access to the general UVA network and the internet.

A high performance firewall, installed in the cellar switch closet (room 075), blocks commonly attacked services and ports (telnet, ftp, ssh, etc.) from non-UVA addresses, and only allows common services like ssh and http to be opened to UVA addresses.

Wireless networks are supplied and managed by UVA/ITS, and are not deployed or managed by the Department.

Policies

1. Devices must be registered by the system staff before being connected to the network. This results in the assignment of an IP address to be served by DHCP, and a name entry in DNS. Connecting an unregistered device to the network results in no service.

2. There is no expectation of privacy when using CS/University networks.

3. Network traffic is being constantly monitored for unacceptable transmissions that violate the Acceptable Use Policy.

4. The UVA central ITS organization provides several wireless networks (*cavalier, eduroam, etc.*) which are not managed by the CS system staff.

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Core Services

Core services (DNS, DHCP, NTP, Print, File, etc.) are centrally provided by a set of enterprise quality high performance servers running CentOS. These servers are located in Rice Hall room 003, and are configured with high availability features like UPS power, redundant mirrored system disks, error correcting memory, and hot swappable disks and power supplies.

 Policy

  1. Only system staff are allowed physical or login access to these servers.

Storage

The Department deploys and administers storage for user home directories, project directories, and research directories. This storage consists of enterprise quality virtual disk arrays which present block level devices to high performance fileservers connected via Fibrechannel. All fileservers use ZFS, and serve filesystems via NFS and SAMBA protocols. The fileservers contain enough memory to allow opened files to be parked in and served from memory, resulting in excellent performance. The SAN network consists of a enterprise quality SAN switches in a single fabric.

 Policies

  1. Storage should only be used for legitimate academic purposes.

  2. Home directories have limited space. For group projects, much larger project spaces can be created that will preserve project data when a member of the group is not longer working on the project.

  3. This departmental storage is backed up. Local storage on individual workstations, laptops, or servers is not.

  4. Only system staff are allowed physical or login access to this storage equipment.

Backup

Since the Department uses ZFS for its filesystems, the backup facility is based upon ZFS '*snapshots*'. Data is snapshotted and saved each night for one month. System staff retrieve deleted files from these snapshots and copy it back to a user's directory.

 Policies

  1. ZFS snapshots are taken of departmental home and project directories every 24 hours.

  2. Snapshots are saved for one month. After one month, their space is reclaimed.

Batch/Job Computing

The Department deploys and administers a wide range of servers that provide batch (job) computing via a job scheduler. The servers, running Linux, range from multi core systems to those with large memory, GPU cards, FPGA cards, NVMe memory, and other features. Users can request one or more servers for job execution, either serially or using parallel computing constructs. A current list of computing resources can be found on our information website www.cs.virginia.edu/computing.

 Policies

  1. Users submit jobs via a batch scheduler, in this case, SLURM.

  2. Users may request one or more servers to execute their job, and specify requirements for the server, for example, number of cores or amount of memory.

  3. Users may request exclusive interactive or batch use of servers for a fixed period of time ("persistent reservation").

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4. The local storage on these servers is not backed up. Network storage, which is backed up, should be used for important data.

5. All servers are registered by the system staff, who assign the server's IP address, owner, and location (room, server rack).

Interactive Server Use

The Department deploys and administers a load balanced cluster of interactive session servers that provide users with general purpose logins. Users can write code, compile code, test code, and perform many other interactive tasks on these servers. Users can also request, through the job scheduler, servers that can be used interactively, where a user essentially 'reserves' a server or servers for their exclusive interactive use.

Policies

1. Long running or CPU intensive processes are prohibited. These should be run on batch job servers.

2. The local storage on these interactive servers is not backed up. Network storage, which is backed up, should be used for important data.

Desktop Computing

The Department provides desktop computers to faculty and graduate students. These computers run either Linux, MacOS, or Windows, and are hardwired to the Department network. Each user has a home directory served by the Department's ZFS servers. Users can access these home directories directly on a Linux desktop, or through SAMBA for Mac and PC desktops. The Department administrators provide users with a recommended, qualified, and tested desktop model and specification that is, by default, ordered in lieu of special requirements.

Policies

1. Desktop computers are installed and configured with a standard operating system image customized for use within the Department. The Windows Distribution Service (WDS) is utilized for network installation of all supported operating systems.

2. All desktop computers are registered by system admins in the CS Admin portal system. Only registered computers receive network access. The registration process records system name, location, IP and MAC address and system owner, and creates DHCP and DNS entries.

3. Supported operating systems are Ubuntu, CentOS, MacOS, and Windows.

4. Operating systems are automatically updated and patched by the relevant OS mechanisms. Linux systems are also updated with the '*puppet*' utility to ensure configuration settings are maintained.

5. Account passwords must be changed on the same schedule as the general UVA domain password, and follow the same guidelines for acceptable length and characters.

Remote Desktop Computing

The Department deploys a NX/NoMachine cluster of several load balanced servers on which users can create Linux virtual remote desktops for their work. These virtual desktops provide a full Linux desktop with graphical tools and all the standard software available on any other server.

We also deploy a general purpose Windows server that provides up to 25 Windows remote desktop sessions. This is useful for students and faculty who need to run Windows software but do not have Windows desktops or laptops.

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Software

The systems support staff installs and supports ~60 software packages for the Department's users. These software packages are installed centrally, and are accessible on a network share that allows a user on any of our servers to execute a simple set of commands to load and use the software. This frees our users from having to install applications themselves, saving considerable time and effort.

The Dept. centrally provides language compilers, interpreters, optimizers, and debuggers for most languages (C, C++, java, python, go, perl, R, FORTRAN, etc.), web development packages, code development environments, GPU support libraries (CUDA, TORCH, etc.), parallel computing support libraries (openmpi, parallel), statistical and mathematical packages (matlab, etc.), databases (MySQL), and various editors. Users can request new packages to be installed by submitting a help desk ticket. Specialized packages that are tied to a hardware platform are also locally installed by the system staff.

Software packages are installed in the `/sw` software partition which is mounted across all Linux servers. The `module list` command allows the user to see what software is available. A `module load` command loads the software from the central repository and also checks out a license (if applicable).

Policies

1. Windows desktop software is installed from the WDS server, and is updated through that server which notifies the user of the update.

2. MacOS software is installed from the Apple support servers.

3. Ubuntu uses a "software manager" that installs and updates software, notifying the user of the update.

4. CentOS updates are done via the `puppet` package update and configuration facility as initiated by system staff.

Service Requests

Service requests are created by sending email to cshelpdesk@virginia.edu. This automatically enters a ticket into the helpdesk ticketing system. The system, Jira, is a solution that provides ticket tracking, assignment, and requestor acknowledgement and progress reports. System staff are responsible for picking up tickets and working on them until resolved. A history of tickets is retained indefinitely.

Typical service requests are for account creation/deletion, increased disk space, access privileges, equipment purchasing, and elevated privileges.

Account Maintenance

User accounts for faculty, graduate students, and undergraduate students are created in the CS "domain".

Policies

1. Faculty are issued accounts as soon as they have joined the university, and those are retained   until one month after they separate from the university.
2. Graduate students are issued accounts when they matriculate to the university, and are removed   o n e   m o n t h   a f t e r   they depart.
3. Undergraduate students are not issued accounts by default, but will be issued upon request. While no faculty sponsorship is required, the account's information will include the name of their advisor.
4. System staff accounts are maintained for one month after a staff member has separated from the department; staff accounts are treated in a similar fashion to student accounts; a   current faculty member may continue to sponsor the staff account.
5. Front office staff accounts are disabled once the staff member separates from the University. However, due to different retention requirements, staff member files are retained for use by remaining staff members.

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6. Users will be notified of pending deletions for accounts if they wish to extend the account(s) for one year. After two weeks, if no response is made, the account is removed. Faculty who wish to retain data from accounts but do not wish to retain the account are responsible for moving that data elsewhere on the system (into their own account or a research project account).

7. Deleted accounts are archived for one month after the account's data is removed.

8. Special purpose 'project' accounts are created for group use, but these accounts do not permit interactive login.

9. Users who do not have an active, official affiliation with the department must have a faculty sponsor for their account.

10. Email accounts are handled by the ITS email system, and are not created in the CS Dept. However, a legacy "@cs.virginia.edu" email forwarder is maintained.

11. Users receiving new accounts must review the Acceptable Use Policy. Upon first login, their password must be changed. Per policy, this change constitutes an acceptance of the Acceptable Use Policy.

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