Introduction to SCS Computing

SCS Computing Facilities
School of Computer Science
Carnegie Mellon University

SCS Help Desk
Gates Hillman Complex 4201
Monday—Friday 9am to 5pm
(412) 268-4231
help@cs.cmu.edu

SCS Help Pages
https://www.computing.cs.cmu.edu

Updated 7/31/20
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1. Welcome

Welcome to the School of Computer Science at Carnegie Mellon University!

This document offers an overview of the SCS computing environment for new users at the School of Computer Science. This is not intended to be a comprehensive set of instructions, but a good place to start gaining familiarity with the computing environment.

Throughout this guide we will provide links to more information on our Help Pages:

http://computing.cs.cmu.edu

1.1. Getting to Know SCS Computing Facilities

1.1.1. What We Do

The SCS Computing Facilities staff supports all aspects of computing for the School of Computer Science. We provide:

**End User Support**
- SCS Help Desk
- User Consulting
- Research
- Documentation
- Technical Procurement
- Account Management
- Operations
- Loaner Equipment
- Resource Management

**Computing Support**
- Hardware Maintenance, Upgrades & Repair
- Software Installation, Maintenance & Upgrades
- Requirements Consulting
- Product Research
- Software Licensing
- Virtual Machines

**Infrastructure Support**
- Authentication
- Calendaring Services
- Printing Services
- Archive Backup Services
- Data Protection Service
- Web Services
- High Performance Computing

...and anything else related to the SCS computing environment. If you have questions, please ask us!

1.1.2. What We Can Help With

While we are unable to assist directly with problems, requests, or concerns relating to other computing environments on campus (Andrew, ECE, etc.), we are happy to act as liaisons to help address any issues you may have that involve computing outside of SCS.
1.1.3. The SCS Help Desk

The SCS Help Desk is the place to go for support; you are welcome to send us an email, give us a call, or drop by in person with any and all of your questions and requests.

SCS Help Desk Hours

The SCS Help Desk is open:

9am to 5pm
Monday—Friday

Visiting the SCS Help Desk in Person

The SCS Help Desk is located at:

Gates Hillman Complex
Room 4201

Reaching the SCS Help Desk by Phone

On campus:

x8-4231

Off campus:

(412) 268-4231

Reaching the Help Desk via Email

The SCS Help Desk accepts email at:

help@cs.cmu.edu

After Hours Support

After hours support is provided by SCS Operations. The Operations Desk can be reached by phone at:

(412) 268-2608
1.1.4. The Help Pages
The SCS Help Pages are our online resource for documentation, tools, solutions to common SCS computing problems, and news about computing at SCS. You can use the Help Pages to learn more about the computing environment, manage your passwords and account preferences, and keep up to date with current events that affect the facility.

1.1.5. Useful Links for User Support

Change Your Kerberos and Windows Passwords
https://computing.cs.cmu.edu/help-support/instance-manager.html

Publish a Web Page
https://computing.cs.cmu.edu/help-support/web-publishing.html

1.1.6. Useful Links for Computing Support

Register Computer Equipment for the SCS Wired Network
https://computing.cs.cmu.edu/help-support/equip-registration

Recommended Hardware Configurations
https://computing.cs.cmu.edu/desktop/supported-hardware.html
1.2. Getting to Know the School of Computer Science

The SCS community follows the Reasonable Person Principle. It holds that reasonable people strike a suitable balance between their own immediate desires and the good of the community at large.

- Everyone will be reasonable.
- Everyone expects everyone else to be reasonable.
- No one is special.
- Do not be offended if someone suggests you are not being reasonable.

The SCS community has also developed a set of rules and customs for behavior that is generally considered acceptable by others in the Department. These rules suggest ways to conserve and share public resources, as well as how to best be a reasonable and responsible member of the SCS community. We present some guidelines to help you get off to a good start.

1.2.1. Shared Computing Resources

Help keep our computing environment safe and working well:

- Keep your account and its password private. You are responsible for anything done from your account.
- Notify SCS Computing Facilities in advance and read the section on Network Usage Policy before connecting any computer or other networked device to our network.
- If you need to make multiple copies of a document, use a photocopier.
- Print large documents at off-peak hours.
- Respect others’ privacy.
- Do not read someone else’s files unless you know you have permission: if in doubt, always ask for permission, even if that person has not employed any file protection mechanisms.
- Consider printer output private.
- Make sure that all of your computers have been kept up to date with all of the current patches.
- Do not use government-sponsored equipment and resources to post messages outside of SCS for commercial gain.

There are socially-acceptable ways of using digital communications:

- Keep messages short.
- Don’t send anonymous messages or hate mail—these actions can result in the loss of your account privileges.

1.2.2. Locating People

There are several online directories that can easily be used to get information about members of the University community.

SCS Directory

The School of Computer Science maintains an online directory of all current faculty, staff, and graduate students who are part of the SCS community. The directory can be accessed at the following website:

https://www.cs.cmu.edu/directory/

Campus Directory

Carnegie Mellon maintains an online directory of all current faculty, staff, and students affiliated with the university community. The directory can be accessed at the following website:

https://directory.andrew.cmu.edu/
2. The SCS Environment

2.1. End-User Resources

Most departments in the School of Computer Science will provide incoming faculty, PhD students, and staff with a desktop or a laptop computer that has been configured by SCS Computing Facilities.

For more about support for end-user resources, please see End-User Computing on page 29.

2.2. Personal Resources

You are welcome to use personally owned computers, mobile devices, and other equipment within the SCS environment.

Personal equipment that causes problems on the SCS network may be blocked from network access as a result; please see §5.1. SCS Network Use Policies on page 15.

For more about connecting personally owned computers, mobile devices, and other equipment to the wireless network, please see §5.5.1. Computing Services Wireless in SCS on page 20.

Support for personally owned equipment is limited; we can only provide best-effort support, and support for personally owned equipment is not given priority. Personally owned equipment is ineligible to enroll in hardware or software support from SCS Computing Facilities staff. Some personal devices are permitted to use the Crashplan data protection client.

2.3. Shared Resources

SCS Computing Facilities provides remote access to Linux services through a general purpose Linux system.

Accessing The General Purpose Linux Services

The Linux General Purpose (GP) services may be accessed via any SSH client. Use an SSH client to connect to the following hostname:

    linux.gp.cs.cmu.edu

You can log in with your SCS username and Kerberos password.

The Linux GP Services can be used for access to command-line or SFTP clients.

For more information about using the Linux GP Services, please see the help pages:

    https://computing.cs.cmu.edu/desktop/os-linuxgp.html
2.4. Passwords

Within the SCS Computing environment, you will have several different passwords. Below is an overview of the most frequently used passwords and their purposes.

Types of Passwords

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<th>Type of Password</th>
<th>Description</th>
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<td>Kerberos</td>
<td>This is your main username/password combination in SCS. This password is used to log in to any website or service protected by SCS Web Authentication. This password is also used to log in to Linux machines in the SCS Environment. This username and password are assigned to you when you first join the SCS community. You will need to change this password; please see Changing a Kerberos Instance Password on page 7.</td>
</tr>
</tbody>
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| Andrew           | This password is used primarily to authenticate to Windows-based machines, but is used for other services, such as:
  • Access to Resource Scheduler
  • Printing to SCS printers
  • Cluster authentication |

2.5. Password Security

It is important when setting your passwords to choose a strong password. A common or weak password is a means by which any account can be broken into by an attacker. A strong password is one that is at least eight characters, and includes a combination of letters, numbers, and symbols. Your password should be easy for you to remember, but difficult for others to guess. It should not be a word that is found in the dictionary.

Note: It is very important that you use a unique password for each system. You should never re-use old passwords or a password used for any other purpose. Below is a link to ISO’s guidance on password management:

https://www.cmu.edu/iso/governance/guidelines/password-management.html

Password Managers

For this purpose, you may choose to use a password manager to maintain your list of strong, unique passwords (or to generate random passwords for you, though these are harder to remember if you don’t have access to your password manager).

Here is information about password managers (including vetted managers) by CMU Information Security Office:

https://www.cmu.edu/iso/governance/guidance/password-managers.html
2.6. Changing Passwords

If you suspect that your account has been compromised, you **must** change your password immediately!

If you need any assistance with any password change, please visit the SCS Help Desk in person. Please remember to bring valid Photo ID for any password changes. For remote password resets, see §2.6.2 Forgotten Passwords.

2.6.1. Managing Kerberos Instances

To create, remove, or update your Kerberos instances, please go to the SCS Kerberos Instance Manager in any web browser: https://computing.cs.cmu.edu/help-support/instance-manager.html

To use the SCS Kerberos Instance Manager, you will need to authenticate via WebISO (see Figure 1):

![Figure 1: Authenticating with SCS WebISO](image)

Once authenticated, you can use the SCS Kerberos Instance Manager to create new instances and change instance passwords (see Figure 2):

![Figure 2: The SCS Instance Manager](image)

Note: you may see Password Instances that do not apply to you; you may ignore them.
Changing a Kerberos Instance Password

If a Kerberos instance already exists, but you need to change the password for that instance, you can use the SCS Kerberos Instance manager to reset that password.

To change the password of an existing instance with the Instance Manager:

1. Click **Change Password** next to the appropriate instance.
2. Enter and verify the new password.
3. Click **Change Password** to set the new password.

2.6.2. Forgotten Passwords

If you have forgotten any of your passwords and need assistance in resetting them, please visit the SCS Help Desk in person. Please remember to bring valid Photo ID for any password changes.

Please note: The SCS Help Desk cannot reset /admin or /root passwords.

Should you need to reset your password remotely, the SCS Help Desk can schedule a video chat to confirm your identity and reset your password. Supported video chat clients are: Zoom, Google Hangouts, Apple FaceTime, and Skype.
2.7. Logging In

When your SCS account is created you will receive the following:

- A Kerberos username and password; these have been sent to you via email.

2.7.1. Logging on to Windows

On a Windows-based machine, you will be prompted to click any button to log in.

Once you click a button, you will see a login window with two fields: Username and Password. Below the password field it should read **Sign in to: Andrew** (see Figure 3).

You will use your Andrew username and password to log in.

2.7.2. Logging on to Linux

In order to log in to an SCS Linux machine you need both an SCS Kerberos account and a local account on the particular machine to which you wish to log in to. Contact the SCS Help Desk and ask them to create this local account once your main SCS user account has been created and you have a specific Linux machine you wish to access (if you have received a graduate student machine from your department you will have an account on the machine assigned to you). The owner of the Linux machine will be contacted to approve the request. Once this local account has been created, simply use your Kerberos username and password to log in to the machine (see Figure 4).

2.7.3. Logging on to Mac OS X

To log in to a SCS Mac computer running OS X you will need a local user account. Local user accounts on Mac computers are added when the machine is initially configured by SCS Computing Facilities. If you have a Mac computer, your initial account password will be provided to you.

To log in to your SCS Mac computer, use your SCS username and local password (see Figure 5).
3. Electronic Mail

3.1. Delivery Options

Delivery to your Andrew Mailbox
Your email will be delivered to your Andrew mailbox that is provided by the university. This can be accessed through the webmail portal at email.cmu.edu.

You may use a variety of clients to access your email on the Andrew server; we support several clients on supported operating systems. We also support mobile device email clients. Instructions for using a client to access your email can be found here:
https://computing.cs.cmu.edu/comm-collab/email-clients

3.2 Delivery Options

Supported Standalone IMAP Clients
We support a wide range of IMAP clients to check your Andrew mail:

Windows
- Thunderbird
- Outlook

OS X
- Thunderbird
- Outlook

Linux
- Thunderbird

Configuration instructions for supported email clients can be found at the following URL:
https://computing.cs.cmu.edu/comm-collab/email-clients.html
3.3. Email Security

Computer viruses, Trojans, and other malware often try to infect your computer via email. Bad actors may also try to use email to lure you into providing sensitive information. It is important to exercise caution when dealing with email that appears suspicious, or is sent from an untrusted source.

Neither SCS Computing Facilities nor CMU Computing Services staff will ever ask you for your password.

If you have any questions or suspicions about a particular message, please contact the SCS Help Desk.

3.3.1. Attachments and Trojans

To reduce the likelihood of being infected by a virus or a Trojan via an email message, use the following guidelines.

Do not run or open email attachments unless:

- You know the sender
- You expect an attachment from that person
- The subject line of the mail and type of attachment fit with what you’re expecting from the sender

Do not run programs from untrusted sources. Spam mailers and email viruses have the ability to forge messages to make it appear as if the email is coming from someone you know. If you have suspicions about where an email message came from, please contact the SCS Help Desk.
3.3.2. Phishing
Phishing is a tactic of convincing someone to reveal sensitive information, such as:

- Passwords
- Credit card numbers
- Banking details

...or other similar information through misdirection, deception, or other subterfuge. Phishing often takes the form of email messages.

Phishing messages often request or demand personal information, usually with some sense of urgency or threat that a service or opportunity is about to expire. If you receive a notice of loss of access or an impending fine that looks legitimate, treat the message with caution and verify the contents of the message through other means (via phone, etc.) before following the instructions in the message.

Phishing attempts via email often have clickable links embedded in the message, which can misrepresent themselves as links to the websites of well-known companies or services. If you are at all suspicious of a message containing clickable links, always manually check the link before clicking on it.

**Note:** SCS Computing Facilities staff will *never* ask you for your password.

If you encounter a message that demands personal details, always check to make very sure the message is legitimate. You can report phishing attempts to the CMU Information Security Office through the PhishAlarm button in Google Mail and Exchange or email (iso-ir@andrew.cmu.edu). If you have any questions about a suspicious email, or would like assistance with verification, please contact the SCS Help Desk.

3.3.3. Displaying Remote Images
Most modern email clients have the ability to display images embedded in an email message. Sometimes, these embedded images are not included in the message itself, but are served off of a remote webserver.

These remote images can pose a privacy risk. If the sender is monitoring the webserver that is serving the images in your mail, when you read the message and load the remote images, the sender will be able to verify your email address and note when the email was read.

Most modern mail clients will allow you to turn off automatic loading of remote images. If the option is available, we recommend that you set your client to only load remote images on demand, and then only load remote images from trusted sources.
3.4. Spam and Virus Detection and Filtering

3.4.1. Server-Side Tagging and Filtering
All incoming email is scanned for spam content and viruses. We use the Pure Message filtering service offered by Sophos to score messages for spam and flag messages with malicious attachments.

Pure Message works by applying a set of rules and checks to each piece of email. If Pure Message discovers suspicious patterns in the email, the service will tag the piece of email as spam. By default, email that has been tagged as spam will be automatically filed into your SPAM folder; you may also set your preferences to discard spam entirely.

Note: By policy, email that has been tagged as spam will not be forwarded to an account outside of Carnegie Mellon University.

If Pure Message discovers a virus in an attachment, the message will be delivered with the attachment removed and [PMX-Virus] prepended to the Subject header.

3.4.2. Client-Side Spam Filtering
Many email clients also offer built-in SPAM filtering. Client-side SPAM filters usually work by training. You can teach the filter what to treat as SPAM, and the filter will adapt to your incoming mail as it learns to discern good mail from unwanted mail.

Because client-side SPAM filters can sometimes treat legitimate mail as SPAM, we recommend using client-side filters only when absolutely necessary.
4. Printing

SCS Computing Facilities provides support for a range of public printers distributed within SCS designated spaces, along with infrastructure that allows printing from Windows, Mac, and Linux hosts.

4.1. Printing Etiquette

The public printers in the School of Computer Science are a shared resource. For that reason, members of the community should:

- Only print large jobs at night or off-hours
- Use SCS printers only for SCS-related work
- Preview your output before printing

4.2. Getting Help

If you have a problem with a printer, contact the SCS Help Desk to report printing problems during normal business hours (Monday-Friday, 9am-5pm).

SCS Operations also provides after hours printer support for many printer problems, such as being out of toner, routine paper jams, etc. SCS Operations may be reached by calling:

(412) 268-2608

More severe printer problems will need to be handled during normal business hours. Print jobs can be released from any of our public printers without having to resubmit the job.

4.3. List of Printers

To review the full list of all available public printers and their locations, please refer to:

https://computing.cs.cmu.edu/desktop/printer-list
5. Networking

The SCS network is one of three network entities on campus. In addition to the SCS network, the other two networks are the ECE Department network managed by ECE Facilities, and the Computing Services network managed by CMU Computing Services.

The Computing Services network provides local network connectivity for everyone on campus except for wired connections in SCS offices. Computing Services also provides the campus with connectivity to both the commodity Internet and research networks. The CMU Computing Services networking group manages the CMU-DEVICE, CMU-GUEST, and CMU-SECURE campus wireless networks.

5.1. SCS Network Use Policies

The SCS network is vital to the School’s research and educational activities.

- Use only IP addresses that have been assigned to your host.
- Configure your machine to use DHCP.
- Use only authorized DHCP servers.
- Do not use unpatched or compromised hosts.
- Contact the SCS Help Desk before performing any network-related experiments which may adversely affect network performance.
- Do not install or use unauthorized wireless access points.
- DHCP addresses are persistent and will not change unexpectedly in the SCS environment.

To help prevent network problems and assist SCS Computing Facilities in fixing problems when they occur, people using the SCS Network must abide by the network use policies given below. These policies are meant to supplement the official Carnegie Mellon University computing policy and provide some SCS-specific additions to that policy.

SCS Computing Facilities reserves the right to disconnect or otherwise remove hosts and equipment from the network without notice if they:

- Cause technical issues that impede other users
- Violate network usage policies
- Use an unassigned or unauthorized network resources
- Show signs that they have been compromised

SCS Computing Facilities reserves the right to monitor network traffic in order to detect or debug network problems and to detect unauthorized use of the network or activity that violates network usage policies. We reserve the right to scan any host or equipment connected to the SCS network for open ports, possible security holes, or any other information that may be gained by scanning. By using the SCS network, or connecting hosts or equipment to the SCS network, you consent to such monitoring and scanning.
5.1.1. Connecting Hosts to the Network

You must register any host or network device that you would like to connect to the SCS network with SCS Computing Facilities. To register a device to use the SCS network, you must provide all of the following information about the device before putting it on the SCS network:

- device type
- asset tag number
- serial number
- location
- hardware address
- contact information

**An exception:** When registering personally owned equipment for a network connection, you do not need to provide an asset tag number.

You must notify us if any of the above information changes for any network connected device. It is especially important that SCS Computing Facilities is notified when a machine is moved. Moving a machine may require an IP address change to the machine and network connectivity may be inconsistent at best without the IP address change.

The wired network in SCS buildings belongs to the SCS network infrastructure. The wireless network is part of the campus network and is managed on our behalf by campus Computing Services. For more about the wireless network at Carnegie Mellon, please see §5.5. Wireless Networking on page 20.

Use the Equipment Registration form found at the following URL for all new registrations and updates of SCS network-connected devices:

https://computing.cs.cmu.edu/help-support/equip-registration

Only in special cases will we give out an IP address without knowing the host's hardware address.

Hosts, equipment, and cables/wiring should not be connected to the SCS network, moved to different network outlets, or reconfigured in any way that might affect network performance or functionality, without prior notification and approval of SCS Computing Facilities.

Outlets are not automatically activated. If you are moving your computer to an unused outlet, you will need to request the activation of that outlet. To request an activation either send a picture of the outlet or make a note of the outlet number beginning with an **R**, which will be visible on a label attached to the network port and follow this form:

*R00A00-000-00*

Please send any activation request, including the appropriate outlet number, to help@cs.cmu.edu.
5.1.2. **Host Naming Conventions**
The machine naming convention here in SCS is:

```
hostname.project.department.cmu.edu
```
- The project component of a hostname must somehow be related to SCS or CMU.
- Project subdomains will only be assigned for groups of machines relating to the project.
- SCS Computing Facilities tries to avoid having multiple hosts that have the same hostnames.
- All personally owned machines will be assigned a name in the .pc.cs.cmu.edu namespace without exception.
- SCS Computing Facilities reserves the right to reject inappropriate hostnames.

5.1.3. **Network Usage Restrictions**
You may not use the SCS network or data gathered from the SCS network for purposes of gaining or attempting to gain unauthorized access to hosts, networked equipment or data. Any use of the SCS network to scan, break into, attempt to break into, or intentionally degrade the performance, functionality, or network connectivity of hosts or other networked equipment is prohibited, unless:

- You have the permission of the administrator(s) of said hosts and/or equipment,
- you notify SCS Computing Facilities prior to engaging in the activity,
- and the activity will not cause service or performance problems for other hosts or equipment on the network.

Some exceptions may be granted for non-obtrusive scanning, network measurement, or other activities, but you must first notify SCS Computing Facilities as well as obtain permission before beginning any activity that could affect the network.

Network monitoring for research purposes or debugging network problems is allowed. Please contact SCS Help Desk for assistance. Monitoring is subject to relevant federal, state or other laws. It is expected that people collecting such data will respect the privacy of anyone whose traffic is incidentally collected by such activities. Network monitoring or packet sniffing for the purposes of intercepting email, passwords, or other personal data without the consent of all parties is not permitted.

Any use of the SCS network that may possibly affect network performance, routing, connectivity, or possibly cause service or performance problems for other hosts or equipment must be approved by SCS Computing Facilities beforehand.
Using the SCS network for purposes of harassment, fraud, sending threatening communications, inappropriate sending of unsolicited bulk email, or any violation of applicable federal, state or other laws, or university policy, is prohibited.

Any use of the SCS network or hosts for commercial purposes or personal gain, except in a purely incidental manner, without advance authorization is prohibited.

5.1.4. Running Network Services

If you install, enable, or administer any network-aware software on a host, including Web, FTP, SSH, file-sharing, and operating system services, you are responsible to make sure the software does not interfere with network operation, cause problems for other hosts on the network, provide unauthorized access to hosts or data, or otherwise violate network usage policies.

You are responsible for making sure that any network-aware software that you install or administer is kept up-to-date with respect to security patches, and for taking appropriate steps to prevent unauthorized access or use of such software. Hosts or other networked equipment running software or services that are known to be insecure, or that are configured in an insecure manner, may be disconnected or otherwise removed from the network.

If a service generates a very large amount of network traffic, we will need a work-related justification and may ask you to find ways to reduce the amount of traffic.

Use of such services for illegal behavior, including illegal distribution of copyrighted materials without the consent of the copyright holder, is prohibited.

5.2. Computing Services Bandwidth Restrictions

CMU Computing Services monitors university data network and Internet bandwidth consumption to ensure that this shared resource is not abused. There is no bandwidth quota for research network traffic. For more information on CMU Computing Services usage Guidelines see:

https://www.cmu.edu/computing/services/endpoint/network-access/guidelines/bandwidth.html

If you need to use more bandwidth than is allowed by campus policy, you can request an exemption from the bandwidth limit. For information about how to request a bandwidth exemption, please see:

https://www.cmu.edu/computing/services/endpoint/network-access/guidelines/bandwidth.html
5.3. Hosting Domains

If your project is using a vanity domain, we may be able to host that domain. We can host domains for both website and email traffic under certain conditions.

5.3.1. Domain Hosting

- You can use equipment on the CMU 128.2.*.* and 128.237.*.* IP address space to host a domain as long as it is non-profit and the domain is .org.
- SCS Computing Facilities will provide name service for a domain if the domain is related to SCS or CMU research/educational non-profit activities.
- SCS Computing Facilities does not delegate DNS for SCS or subdomains of SCS projects.

A special address space has been set aside for non-commercial domains with a top level domain other than .org. Domains hosted in this address space must be related to the School of Computer Science and/or Carnegie Mellon University. Please contact the SCS Help Desk if you have a domain that requires this special IP address space.

5.3.2. Email for Hosted Domains

We can provide the following email services for hosted domains:

- mail aliases
- mailing lists
- mail forwarding

Email services for hosted domains are only available for domains associated with CMU sponsored research.

5.4 VPN

The Cisco AnyConnect VPN (Virtual Private Networking) software allows a computer on another network to appear that it has an CMU name and IP address. Using VPN, a remote host can access restricted network services that can only be accessed by SCS hosts. The VPN client is available for Windows, Mac OS X, and Linux.

Download the VPN client for Windows, Mac and Linux systems from:

https://www.cmu.edu/computing/software/all/cisco-anyconnect/

For a description of how to use the VPN, please see:

http://www.cmu.edu/computing/services/endpoint/network-access/vpn/index.html
5.5. Wireless Networking

The campus wireless network is administered and maintained by campus Computing Services.

While SCS Computing Facilities is not responsible for the campus wireless, we can help verify configuration settings. We can also work with Computing Services to report and track outages in the campus wireless networks. If you experience wireless issues please contact the SCS Help Desk.

5.5.1. Computing Services Wireless in SCS

Many users in the SCS community use the campus wireless networking service. However, there are some things to consider when using these wireless networks:

- A wireless connection is not as fast or reliable as a wired connection
- You must use the CMU VPN to access the following services:
  - Windows domain services (with some exceptions)
  - Any other SCS service restricted by IP or hardware address.

Wireless is not meant to be a substitute for wired Ethernet for tasks that require large amounts of bandwidth. For example, we cannot create archival backups of hosts over the wireless network.

If you have any questions about Computing Services wireless service, contact the SCS Help Desk.

5.5.2. Computing Services Secure Wireless

Campus offers an encrypted wireless network that requires authentication to join. This secure wireless network is named CMU-SECURE.

You do not need to register your device to use the CMU-SECURE wireless network. To use this network, connect your device to the network named CMU-SECURE. You will be prompted for a Username and password. Use your Andrew Username and password to connect to the CMU-SECURE network. In some cases, you may be asked to verify the connection.

5.5.3. Computing Services Open Wireless

Campus offers a wireless network that requires registration to join. This open wireless network is named CMU-DEVICE.

Traffic on the CMU-DEVICE wireless network is unencrypted. If you have concerns about transmitting sensitive data over a clear network, we recommend either using a VPN client, or using the CMU-SECURE wireless network.

Using the CMU-DEVICE wireless network requires registration. To register your wireless device to work with the campus open wireless network, follow the instructions at the following link:
Once registration is complete, you will be directed to a web page confirming that your device now has access to the campus CMU open wireless network.

Until you have properly registered your device for use with the CMU wireless network, all network connections except to the Computing Services authorization website will fail. Please register your device before attempting to use the CMU wireless network for reaching mail servers, filesharing servers, or other types of connections.

5.5.4. Computing Services Guest Wireless

Campus offers an encrypted wireless network for temporary use by guests of the University. This secure wireless network is named CMU-GUEST. This network should not be used by current students, faculty, or staff. This network requires an access code to join. Faculty and staff can use the Computing Services' Event Manager to create access codes for guests to connect to the CMU-GUEST network. For more information about the Computing Services Event Manager, please see:

https://www.cmu.edu/computing/services/endpoint/network-access/wireless/how-to/guest.html
6. AFS

AFS is a distributed file system providing a client and server architecture that offers:

- File sharing within a single name space
- Security
- Scalability
- Transparent data migration

For hosts running Mac OS X Mojave or Windows 10 users should not use OpenAFS, but should use another client such as Auristor or a SFTP client (i.e. FileZilla). AFS is also used to share and store data for classes, projects, and users. Your SCS website is served from AFS. To access your AFS volume, you may connect to linux.gp.cs.cmu.edu using your SCS username and SCS Kerberos password.

Both authentication and the appropriate authorization are required for AFS access.

6.1. Authentication

Authentication is automatic on Linux workstations when you login with your Kerberos password.

Kerberos credentials automatically expire after 24 hours and must be refreshed, even if you remain logged in. You can refresh your Kerberos credentials by using the `kinit` command from a shell window. This will prompt you for your Kerberos password.

6.1.1. Checking Authentication

Use of the `klist` command from a Linux shell window to display your current login credentials:

```
example@linux:~$ klist
Credentials cache: FILE:/tmp/krb5cc_14871_f31544

Principal: example@CS.CMU.EDU
  Issued       Expires         Principal
  Jun  5 12:31:17  Jun  6 12:31:17  krbtgt/CS.CMU.EDU@CS.CMU.EDU
  Jun  5 12:31:17  Jun  6 12:31:17  afs@CS.CMU.EDU

example@linux:~$
```
6.2. Access Control

Permissions in AFS are granted per directory, rather than per file, and handled by Access Control Lists (ACLs) set on each directory. Variable levels of permission may be granted to users and user groups within a particular directory.

6.2.1. AFS Permissions

There are seven AFS permissions. Four permissions affect directories, and the remaining three affect file authorization.

<table>
<thead>
<tr>
<th>Directory</th>
<th>Permission</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lookup</td>
<td>l</td>
<td>Affords access to a directory to perform other operations, and list directory contents.</td>
</tr>
<tr>
<td>Insert</td>
<td>i</td>
<td>Allows file and directory creation or copying.</td>
</tr>
<tr>
<td>Delete</td>
<td>d</td>
<td>Allows for removal of files or subdirectories.</td>
</tr>
<tr>
<td>Administrator</td>
<td>a</td>
<td>Allows for changing of the directory ACLs.</td>
</tr>
</tbody>
</table>

File

<table>
<thead>
<tr>
<th>Permission</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>r</td>
<td>Allows for file reads and directory statistics.</td>
</tr>
<tr>
<td>w</td>
<td>Allows for writing changes to files.</td>
</tr>
<tr>
<td>k</td>
<td>May run applications that issue system calls to lock files within the directory.</td>
</tr>
</tbody>
</table>

AFS ignores any individual file permissions except for the owner’s. Read, write, and execution file modes may be removed on a file. Denying owner permissions will remove the ability for anyone to access the file, including the owner. The Access Control List is comprised of all the users and groups, and their corresponding level of authorization within a directory.

6.2.2. Displaying an Access Control List

The command line interface of a Linux shell may be used to list the membership and authorizations of a given directory with the `fs la` command:

```
example@linux:~$ fs la .
Access list for . is
Normal rights:
    system:anyuser l
    example rlidwka
example@linux:~$
```
6.2.3. Managing Access Control Lists

Owners or users with administrative permissions may edit or add additional entries to the directory’s ACL. The Linux shell command `fs sa` may be used to manage directory ACLs.

In the following session, our example user:

1. Displays the access list on their home directory using the `fs la` command
2. Sees that the user bovik has read access
3. Removes specific access rights for the user bovik using the `fs sa` command (note: this command is non-recursive)
4. Checks to make sure that access is revoked

```
example@linux:~$ fs la .
Access list for . is
Normal rights:  
  system:anyuser l
  bovik r
  example rlidwka
example@linux:~$ fs sa . bovik none
example@linux:~$ fs la .
Access list for . is
Normal rights:  
  system:anyuser l
  example rlidwka
example@linux:~$
```

6.3. Managing PTS Group Memberships

Groups may contain multiple users, and allow for easy management of directories. Newly created subdirectories inherit the permissions of the parent directory, including any existing group entries. Managing similar levels of access through group memberships is easier than adding and removing individuals from many ACLs across multiple directories.

For example, you may choose to create a group as a subtext of your own username, `username:groupname`, and add that group to the appropriate directories as you would an individual user. Group creation and membership management must be done from the Linux shell with the use of PTS commands.

AFS has several special group definitions already in place. For more, please see:

https://computing.cs.cmu.edu/help-support/afs-groups.html
### 6.3.1. Making a New PTS Group

Our example user would like to have a PTS group to manage who has read access to his home directory.

The first step is to create the group, using the `pts creategroup` command:

```bash
example@linux:~$ pts creategroup example:readers
Group example:readers has id -4928
example@linux:~$
```

Next, our example user must grant the appropriate access to the group with the `fs sa` command (along with the `fs la` command to make sure the Access Control List was properly modified):

```bash
example@linux:~$ fs sa . example:readers read
example@linux:~$ fs la .
Access list for . is
Normal rights:
  example:readers rl
  system:anyuser l
  example r lidswka
example@linux:~$
```

Our example user needs to add other users to the group using the `pts adduser` command:

```bash
example@linux:~$ pts adduser -user bovik -group example:readers
example@linux:~$
```

The command `pts membership` can be used to check who is on in PTS group:

```bash
example@linux:~$ pts membership example:readers
Members of example:readers (id: -4928) are:
  bovik
example@linux:~$
```

The command `pts removeuser` can be used to remove a user from a PTS group:

```bash
example@linux:~$ pts removeuser -user bovik -group example:readers
example@linux:~$
```

The command `pts membership` will verify the removal:

```bash
example@linux:~$ pts membership example:readers
Members of example:readers (id: -4928) are:
example@linux:~$
```
6.4. Updating Web Pages

Modest websites may be hosted within AFS directories. Security measures restrict the use of PHP, CGI, or other dynamic content generation; however, server-side includes which do not rely on `exec` may be used.

Web content should be located in an exclusive subdirectory of an AFS volume. The permissions on this directory should be configured to provide the necessary AFS access list privileges on for the website to be served by SCS web servers.

6.4.1. Setting Permissions for the Website Directory

Make a web subdirectory within the AFS volume and set the appropriate AFS ACL and permissions. The top-level directory of the volume will have different permissions than its web subdirectories.

If necessary, set the permissions on your AFS home directory so that the web servers can access your www directory:

```
example@linux:~$ fs sa . wwwsrv:http-ftp 1
example@linux:~$
```

Then, set the permissions on your www directory so that the web servers can access your content:

```
example@linux:~$ fs sa www wwwsrv:http-ftp r1
example@linux:~$
```

Subdirectories created within the www directory will automatically inherit the required access list and privileges.

6.4.2. Adding Content

Content for the site may be created using any tools available on the workstation or uploaded to it. We recommend the use of SSH copy (`scp`) or secure FTP (`sftp`) for uploading your web content.

You may use any SCS Linux host where you have an account to upload content; a common choice is to use the General Purpose Linux Server (see §Accessing The General Purpose Linux Services on pg. 8):

```
linux-gp.cs.cmu.edu
```

If you would like to have a personal web page served by the SCS web servers, you will need to place the files that make up your website into the www directory of your AFS home directory.

6.4.3. Privacy and Access Restrictions

Websites served from AFS will honor .htaccess file restrictions. However, we do not recommend any sensitive data such as SSNs, credit card numbers, passwords, etc. to ever be stored on websites.
6.4.4. Linking Your Content to the Web Servers

If your content does not appear at the following URL:

http://www.cs.cmu.edu/~[your username]/

...your content directory may need to be linked to the Web Servers. To link your content to the web servers, please contact the SCS Help Desk.

6.5. AFS Volumes

Units of storage in AFS are referred to as volumes, and are comprised of related directories. The most common example is your home directory, available via the Linux path:

/afs/cs.cmu.edu/user/username

This unified namespace is one of the advantages of AFS. You may access AFS volumes from the same path from any machine in the computing environment where AFS is installed and enabled.

Requesting Volumes and Quotas

Project names must consist of 11 characters or fewer (academic volume names are pre-determined to match the SCS designated course number and year - section numbers are also available, if they are required).

- Project sponsor or course instructor, and one additional individual to be granted full administrative rights within the volume.
- The initial quota request; please limit it to meet your current requirements (it may be resized to meet your future requirements as they change).

Classes may request classwork submission student directories; please include a class roster of only the student usernames, and designate TA usernames to be added for administration of volume contents when requesting a classwork submission folder.

There are different classifications of volumes that may be found within the cs.cmu.edu cell hierarchy. The following summary provides a brief description of the types, their locations, and quota assignments.
### Introduction to SCS Computing

<table>
<thead>
<tr>
<th>Volume Type</th>
<th>Description</th>
<th>Default Quota</th>
<th>Max Quota</th>
</tr>
</thead>
<tbody>
<tr>
<td>User</td>
<td>Home directory. Moderate data requirements. /afs/cs.cmu.edu/user/username</td>
<td>1 GB</td>
<td>10 GB</td>
</tr>
<tr>
<td>Academic</td>
<td>Class directories for sharing common documents. Student dropoff directories available upon request. /afs/cs.cmu.edu/academic/class/classno-termYear</td>
<td>1 GB</td>
<td>25 GB</td>
</tr>
<tr>
<td>Project</td>
<td>SCS Affiliated projects may request space for collaboration purposes. /afs/cs.cmu.edu/project/projectname</td>
<td>1 GB</td>
<td>25 GB</td>
</tr>
<tr>
<td>Backup</td>
<td>Backups for existing volumes made nightly. /afs/cs.cmu.edu/.BACKUP/path-to-main-volume</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Restored</td>
<td>Volumes requested for restore. Making requests as soon as possible increase the likelihood of a specific date being available. /afs/cs.cmu.edu/.RESTORED/path-to-main-volume</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Each volume has a flexible quota assigned to it. The quota may shift in size with the requirements of the volume without adversely affecting the content or availability of the volume.

Quota usage may be determined through the command line interface in a Linux shell using the `fs lq` command:

```
example@linux:~$ fs lq
Volume Name  Quota  Used %Used  Partition
user.example  1000000  25   0%  0%
```

If you require additional quota, please contact the SCS Help Desk.

### 6.6. Backups and Restores

All AFS volumes receive nightly, incremental backups unless specified otherwise. User volume backups from the previous day may be accessed through the symbolic link `OldFiles` in home directories or within the corresponding backup hierarchy.

<table>
<thead>
<tr>
<th>AFS Location</th>
<th>Backup Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>/afs/cs.cmu.edu/user/username</td>
<td>/afs/cs.cmu.edu/.BACKUP/user/username</td>
</tr>
<tr>
<td>/afs/cs.cmu.edu/project/projectname</td>
<td>/afs/cs.cmu.edu/.BACKUP/project/projectname</td>
</tr>
<tr>
<td>/afs/cs.cmu.edu/academic/class/classnum-termYear</td>
<td>/afs/cs.cmu.edu/.BACKUP/academic/class/classnum-termYear</td>
</tr>
</tbody>
</table>

Volume restores for specific days are more readily available for dates within a week of the requested date, otherwise the nearest incremental backup will be used. Please make restore requests as soon as possible.
7. End-User Computing

SCS Computing Facilities can provide support for CMU owned end-user equipment. Some CMU-provided equipment (such as PhD machines) is under full hardware and software support by default, but departments may opt to support machines themselves.

7.1. General Support

7.1.1. Hardware Support

What We Cover

Warranty processing and hosts covered by hardware support are entitled to the following:

- hardware, troubleshooting, & diagnostics
- Out-of-warranty component replacement of failed hardware (cost of hardware not covered)
- Uninterruptible Power Supply (UPS) for use if there is ever a power-loss event (not available for GPU machines)

We can service laptop batteries on supported machines after diagnostic testing has identified that the battery needs to be replaced. Battery replacement due to normal wear and tear is not covered, but should a battery experience an early failure, its replacement will be covered if the machine is under warranty.

Moving Equipment

If you need to move supported hardware, we are happy to assist. Contact the SCS Help Desk to schedule a technician to move your equipment to a new location.

You may choose to move your equipment yourself. If you are moving equipment that connects to the wired network, you may need to request an outlet activation at the new location; please see Connecting Hosts to the Network on page 16. Please make sure to notify us of any equipment you have moved; list the old location, the new location, and the asset number of the equipment in an email to help@cs.cmu.edu.

Unsupported Equipment

We are unable to support personally owned equipment. You should contact your computer manufacturer directly for all problems, diagnostics, and repairs of personally owned computer equipment.

We can help with connecting personally owned equipment with the SCS Computing Environment. For personally-owned equipment, we support connecting to printing, wireless, and other computing services on a best-effort basis.
7.1.2. Backups

The data that you create is the lifeblood of your work, therefore it is critical that it is protected from accidental loss either caused by system failure, inadvertent deletion, viruses, or theft of your device. Since different users have different data protection needs, CMU/SCS Computing Facilities provides several different data protection methods:

**Standard Data Protection**

Recommended for mobile and desktop systems. This system features real-time backup of your data, multiple restore points for data that has changed, and immediate restore of data to any device. This is currently free for SCS users. This service allows for self-service data restores.

**Archival Data Protection**

Recommended for servers and some desktop systems. This system features nightly backups of your system, archival to tape for long-term, off-site storage, and operator-assisted restores of your data. There is a fee for this service.

**AFS File Servers**

All CMU/SCS Computing Facilities supported AFS servers are backed up every night to a tape archival data protection system.

Why would you pick one data protection method over another? These examples might help:

- If you have a laptop that is frequently not on the SCS Wired Network, you should choose Standard Data Protection.
- If you have a desktop that is used for normal office functions (word processing, email, etc.), you should probably choose Standard Data Protection.
- If you have a desktop that has multiple users, or that has SCS business critical data, you should choose Archival Data Protection.
- If you have a server machine, especially one in one of the SCS machine rooms, you should choose Archival Data Protection.

If you have questions about which service to choose, please contact SCS Computing Facilities.

In order to receive backups, a host must be running an SCS Computing recognized operating system. There is a monthly charge for machine backups.
Important note: Hosts are not subscribed to either the Standard or Archival Data Protection systems by default. These services must be specifically requested.

Restrictions on Backups

- We may not be able to provide backups for hosts with unusual software or hardware configurations, extremely large disks, or that have large amounts of data that change on a daily basis.
- If your system is connected via wireless or home network connection, only the Standard Data Protection system is supported.
- We do not back up databases, virtual OS images, or specific file types.
- On all platforms, the backup system is not able to back up open files. Therefore, it is important to close long-running programs (e-mail, calendar programs, etc.) before backups run in order to make sure that data files get backed up successfully.

7.1.3. Restores

In order to request a file restore for systems using archival backups, you must send the following information to the SCS Help Desk at help@cs.cmu.edu:

- The name of the workstation or personal computer.
- The name of the disk area, partition, and/or volume involved.
- The cause of the file loss (accidental removal, disk failure, etc.).
- The current status of the affected disk area, partition, or volume.
- The date at which you believe the file/volume/partition to have been damaged, or from which you would like to restore.
- The complete file names of the lost files.
- The time files were last modified (or created).
- The time files were lost or destroyed.

Insufficient information may delay the restore process.

Before requesting a restore on an AFS volume please check the OldFiles directory in your AFS space:

/afs/cs.cmu.edu/user/username/OldFiles

If the OldFiles directory is not available, please contact the SCS Help Desk for further assistance.

Crashplan data restores can be initiated using the self-service application.
7.1.4. Desktop VM Support
We offer support for a wide range of virtual hosting solutions across all supported platforms. Virtual hosting is available for machines that are subscribed to software support.

VMs are not backed up unless backups have been enabled for that VM. The backup client must be installed on the VM guest and an additional backup support fee will apply. VMs must have a dedicated IP address, and run on machines with a wired ethernet connection to be eligible for archival backups. Crashplan backups can use wireless connections.

For all virtual machine operating systems, SCS Computing Facilities uses the VirtualBox hypervisor client.

7.2. Microsoft Windows Support
SCS Computing Facilities support for Windows-based hosts includes hardware support, installation and support of a baseline software environment, and network backups (if explicitly requested) for SCS owned machines.

SCS Computing Facilities supports most modern versions and configurations of the Microsoft Windows operating system. For more information about Windows support, please see https://computing.cs.cmu.edu/desktop/support-windows.html
### 7.2.1. Software Support
Windows machines built by SCS Computing Facilities are configured with pre-installed software. The baseline software collection is available for distribution from the Andrew Windows software distribution host called Software Center, which is pre-installed on Windows hosts.

For more information about obtaining windows software, please see:

https://www.cmu.edu/computing/software/index.html

Additional software is available from SCS and CMU Windows software distribution servers.

### 7.2.2. Recommended Hardware
Our recommended hardware configurations for new computer purchases can be found at:

https://computing.cs.cmu.edu/desktop/recom-configs.html

To purchase through SCS Computing Facilities, please use the purchase request form:

https://computing.cs.cmu.edu/business/purchasing.html

### 7.2.3. Printing
Detailed instructions for printer setup under Windows can be found in our SCS Help Pages:

https://computing.cs.cmu.edu/desktop/printing-windows-public.html

### 7.2.4. Backups and Restores
Archive backups are available upon request. To have archive backups added to your machine, please send your request to help@cs.cmu.edu asking for backups to be added and include the name of your machine. For data protection service options please visit

https://computing.cs.cmu.edu/backup/

### 7.3. Ubuntu Linux Support
SCS Computing Facilities software support for Linux hosts involves installing an SCS specific Linux environment that provides the means for remote administration, software distribution, network backups, and other services.

Support for Ubuntu Linux PCs includes: network backups (if explicitly requested), and hardware and software support. Users incur a monthly charge for this support.

Software support is unavailable for laptops running Linux.
7.3.1 Software Support
The SCS Computing Facilities supported Linux environment is based on the most recent Long Term Support release of the Ubuntu operating system. In general, all Ubuntu packages found in a standard install are present.

The system command `apt-get` can be used to install any needed software that is not currently installed on your computer.

We offer some popular software as packages that are tailored for use with the SCS environment:

- Mathematica
- Matlab

These packages are available for installation via the `apt-get` package management tool.

Home directories are located on local disk by default. Local home directories should be placed in `/usr0/home` or some other partition which is backed up on a regular basis.

If the computer is under backup support, only `/etc` and directories of the form `/usrN` are usually backed up. Directories in other places, such as `/var/mysql`, are not backed up by default.

7.3.2 Recommended Hardware
Our recommended hardware configurations for new computer purchases can be found at:

https://computing.cs.cmu.edu/desktop/recom-configs.html

To purchase, please use the purchase request form:

https://computing.cs.cmu.edu/business/purchasing.html

7.3.3 Printing
Detailed instructions for printer setup under Linux can be found in our SCS Help Pages:

https://computing.cs.cmu.edu/desktop/printing-linux.html

7.3.4 Backups and Restores
Archive backups are available upon request. To have archive backups added to your machine, please send your request to help@cs.cmu.edu asking for backups to be added and include the name of your machine. For data protection service options please visit

https://computing.cs.cmu.edu/backup
7.4. Apple Mac Support

SCS Computing Facilities is an authorized Self-Service Provider for Apple, Inc. Our trained technicians are Apple certified and are able to perform on-site service repairs for all Apple computer hardware, both in and out of warranty.

Support for Mac computers includes installation of a baseline software environment, network backups (if explicitly requested), and hardware and software support. Users incur a monthly charge for this support.

7.4.1. Centralized and Self-Service Support

As part of the Mac environment, SCS Computing Facilities offers enrollment in a service that allows us to centrally support Mac computers in the SCS Environment. This service is supported by the Casper Suite software from JAMF.

Casper Suite is a centralized maintenance system that makes it simpler to manage software, install printers, and easily perform troubleshooting steps. SCS Mac users can perform these tasks themselves, or rely on SCS Computing Facilities Staff to maintain their machines remotely. Casper Suite also makes it easy to run repair and diagnostic tools for both the user and administrators.

For more information about how Casper Suite can be used in the SCS environment, please see:

https://computing.cs.cmu.edu/desktop/support-mac.html

7.4.2. Software Support

Mac computers built by SCS Computing Facilities are shipped with preinstalled software. The baseline software collection and additional software packages are available through the Self Service application.

For more information about obtaining Mac software, please see:

https://computing.cs.cmu.edu/desktop/support-mac.html

7.4.3. Recommended Hardware

Our recommended Apple product hardware configurations can be found at:

https://computing.cs.cmu.edu/desktop/recom-configs.html

To purchase, please use the purchase request form:

https://computing.cs.cmu.edu/business/purchasing.html
7.4.4. **Printing**

SCS Mac computers use the Self Service application to manage printers. The Self Service application is installed as part of the Casper Suite of management software. For more information about Self Service and the Casper Suite, please see §7.4.1. *Centralized and Self-Service Support* on page 35.

Detailed instructions for printer setup for Mac OS X systems can be found on the SCS Help Pages:

[https://computing.cs.cmu.edu/desktop/printing-mac.html](https://computing.cs.cmu.edu/desktop/printing-mac.html)

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7.4.5. **Backups and Restores**

See the Mac backup documentation for details on our Mac backup system and the limitations on what we can back up. Note that Macs will not be put into the backup system (and thus will not receive backups) unless specifically requested.

[https://computing.cs.cmu.edu/backup/](https://computing.cs.cmu.edu/backup/)
8. Network & Email Security

8.1. Network Security

8.1.1. SCS Network
Per researcher preference, there is no firewall between the SCS network and the Internet. Hosts on our network are constantly being scanned for security vulnerabilities by would-be intruders, and there are numerous break-ins to SCS hosts each year. Almost all of these break-ins are preventable, and most are due to either weak passwords (often cracked via brute-force SSH attacks) or poorly configured or unpatched web applications (Wikis, phpMyAdmin, etc).

8.1.2. To Protect Yourself and Your Computers

- Always use strong passwords, including for temporary accounts and accounts you’ve created in the process of installing a software package. This can’t be emphasized enough.
- Securely configure software you install. This includes using strong passwords for services exposed to the network and restricting access to sensitive services, such as a web application’s administrative console. If you are installing a network-aware software package, you should never trust its default configuration to be secure.
- Keep software you install, particularly software exposed to the network, up to date with patches. If you do not keep your software up to date, there is a good chance that the host running the software on will eventually be compromised.
- Do not send sensitive data, such as passwords, unencrypted over the network.
- Do not reuse passwords.

If you think your machine has been broken into, contact the SCS Help Desk as soon as possible. Even if your machine is not supported by SCS Computing Facilities, you should still let us know about the intrusion.
9. Conclusion

Thank you for reading the Introduction to SCS Computing.

While we hope that this document has provided a gentle and comprehensive introduction to computing at the School of Computer Science, we also know that we have a large and complicated computing environment.

If you have any questions about anything contained in this document, please let us know; we would like to make sure that all of the material presented here is complete and easy to understand.

If you discover that there is material that is not adequately covered by this document, please tell us; while we can't cover everything in complete detail, we are always eager to learn where and how we can improve the material presented in this Introduction.

As you explore the SCS computing environment, we are more than happy to offer explanations, field requests, and provide whatever assistance we can to make your work your focus.

Thanks!