Working Remotely

Secure Shell, Grid Engine, and Screen

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Overview

Outline

What is SSH?

Secure Shell (SSH)

SSH is a network protocol for secure remote communication between two computers. SSH uses public-key cryptography and is based on a client-server architecture.

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OpenBSD Secure Shell (OpenSSH)

OpenSSH is a set of programs that allow secure remote access to another computer using SSH. One of these programs is called “ssh”.

Secure Shell

SSH Features

- Confidentiality
- Integrity
- Authenticity

Secure Shell

What can I do with SSH?

- Get a shell on another computer
- Copy files between computers
- Connect to other computers via the university network

Secure Shell

Selected OpenSSH programs

ssh	Provides shell access to another computer
scp	Copies files between computers
ssh-keygen	Generates a password protected key pair
ssh-copy-id	Copies the public key to a given server
ssh-agent	Program to avoid retyping the password for every connection
sftp	Secure FTP
sshd	SSH server

Secure Shell

Get a shell on another computer

```
ssh username@hostname
ssh -X username@hostname    # enable X forwarding
ssh -C username@hostname    # enable compression
```

Secure Shell

Copy files between computers

```
scp file username@hostname:remote-path
scp -r directory username@hostname:remote-path

scp username@hostname:remote-file path
scp -r username@hostname:remote-directory path
```

Secure Shell

Connect to other computers via the university network I

- Setup dynamic port forwarding with ssh
- Enable SOCKS proxy for the program in question

Secure Shell

Connect to other computers via the university network II

```
ssh -D 1080 username@hostname
```

Secure Shell

How to avoid retyping the password I

- Ensure ssh-agent is started on every login
- Create a public/private key pair with ssh-keygen
- Copy the public key on the server with ssh-copy-id or scp
- Add the new key pair to ssh-agent with ssh-add

Secure Shell

How to avoid retyping the password II

```
ssh-keygen -t rsa
ssh-copy-id username@hostname
ssh-add
```

Outline

What is Grid Engine?

Grid Engine (GE)

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Job Scheduler

A job scheduler is responsible for accepting, scheduling, dispatching, and managing the remote and distributed execution of large numbers of standalone, parallel or interactive user jobs. It also manages and schedules the allocation of distributed resources such as processors, memory, disk space, and software licenses (Source: Wikipedia).

Grid Engine

What can I do with Grid Engine?

For computations which need large amounts of memory or computation time the mathematics departments provide its members access to a cluster with up to 48 GB memory per node. The cluster is accessed with Grid Engine.

Grid Engine

Selected GE programs

qrsh	Submit an interactive job
qsub	Submit a noninteractive batch job
qdel	Kill a job
qhost	Show information about hosts in the cluster
qstat	Show all pending and running jobs
qacct	Post mortem job information

Grid Engine

Selected qrsh flags

-V	Export all environment variables (set this!)
-l	Set a resource limit
-verify	Dry run
-verbose	Be verbose

Grid Engine

Selected qsub flags

-V	Export all environment variables (set this!)
-l	Set a resource limit
-verify	Dry run
-cwd	Execute job in current working directory
-e path	Send stderr output to files in path
-i file	File from which stdin is read
-o path	Send stdout output to files in path
-m be	Send e-mail at beginning and end of job
-M emails	Set receiver e-mail addresses
-N name	Set the job name (alphanumeric ASCII)

Grid Engine

Example

```
qrsh echo 'Hello, world!'

qrsh -V \
     -l h_rt=00:30:00 -l h_vmem=800M \
     matlab -nodisplay -r run_tests

qsub -cwd -V \
     -l h_rt=24:00:00 -l h_vmem=16G \
     -e logs -i job-input -o logs -N ev500k \
     -m be -M user@mail.de \
     matlab -nodisplay -r solve_ev500k
```

Grid Engine

Why resource limits?

- Swapping is awfully slow
- There may be bugs in your program
- The problem at hand may be harder than you think
- You are not the only one using the cluster

Grid Engine

Hints

- Please set resource limits
- Some qrsh flags also work for qsub and vice versa
- Cluster usage varies a lot – take a look at qstat before starting jobs

Outline

Screen

What can you do with Screen?

Screen works in a terminal and has the following abilities:

- Persistent sessions
- open multiple windows
- multiuser access

Screen

Selected Screen command line options

screen	Start new screen session
screen -r	Reattach to an existing screen session
screen -R	Attempt reattaching, otherwise start new session

Screen

Selected Screen shortcuts

Ctrl+a "	Show window list
Ctrl+a c	Create a new window
Ctrl+a A	Set window title
Ctrl+a d	Detach from current session

Screen

Hints

alias screen="screen␣-R"

Outline

Conclusion

Thank you for your attention.

Questions?

Links

- OpenSSH website
- TUB Department of Mathematics: Clusternutzung
- Grid Engine man pages
- GNU Screen website