Basic Shell Scripting

Siva Prasad Kasetti • HPC User Services • 22 July 2026

Quick Recap..

- **HPC User Environment 1**

  1. Intro to HPC
  2. Getting started
  3. Into the cluster
  4. Software environment (modules)

- **HPC User Environment 2**

  1. Basic concepts
  2. Preparing my job
  3. Submitting my job
  4. Managing my jobs

What We'll Cover



1. Introduction

What is Shell, and what is it (and isn't) good for



2. Basic Knowledge

Interactive vs Non-interactive (Shell Script)
Basic Commands & Syntax, Variables
Arrays, Arithmetic Operations



3. Beyond Basics

Subshells, flow control, and text processing



4. Bonus

Where to get help — including generative AI

Download

Example and exercises:

https://www.hpc.lsu.edu/static/training/weekly-materials/Downloads/ShellScripting.zip

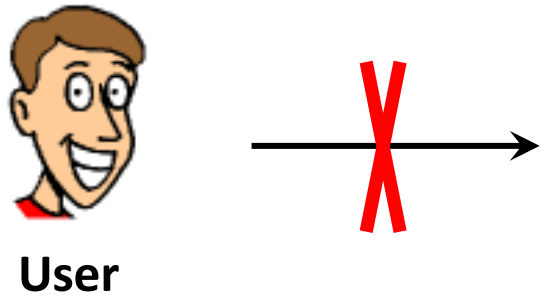
What's Shell?

- **Previously in HPC User Environment 2…**
  - Two types of jobs

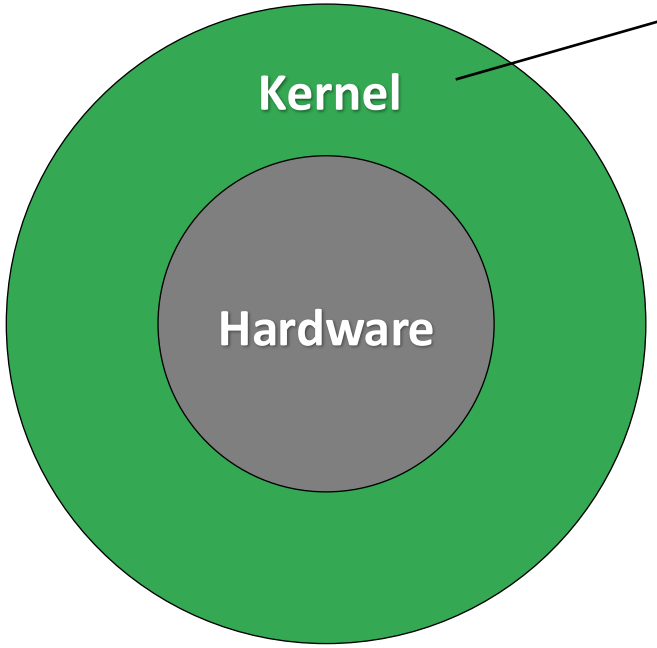
1) Interactive job	2) Batch job
[kasetti@c salloc: 42 salloc: 50 salloc: Pe salloc: lua: Submitted job 921971 salloc: job 921971 queued and waiting for resources salloc: job 921971 has been allocated resources salloc: Granted job allocation 921971 salloc: Waiting for resource configuration salloc: Nodes qbd058 are ready for job	#SBATCH -n 64 module load python cd $SLURM_SUBMIT_DIR ./pi_serial.out 100000000

In both cases, you are accessing a Linux system **through Shell**

What's Shell?



User



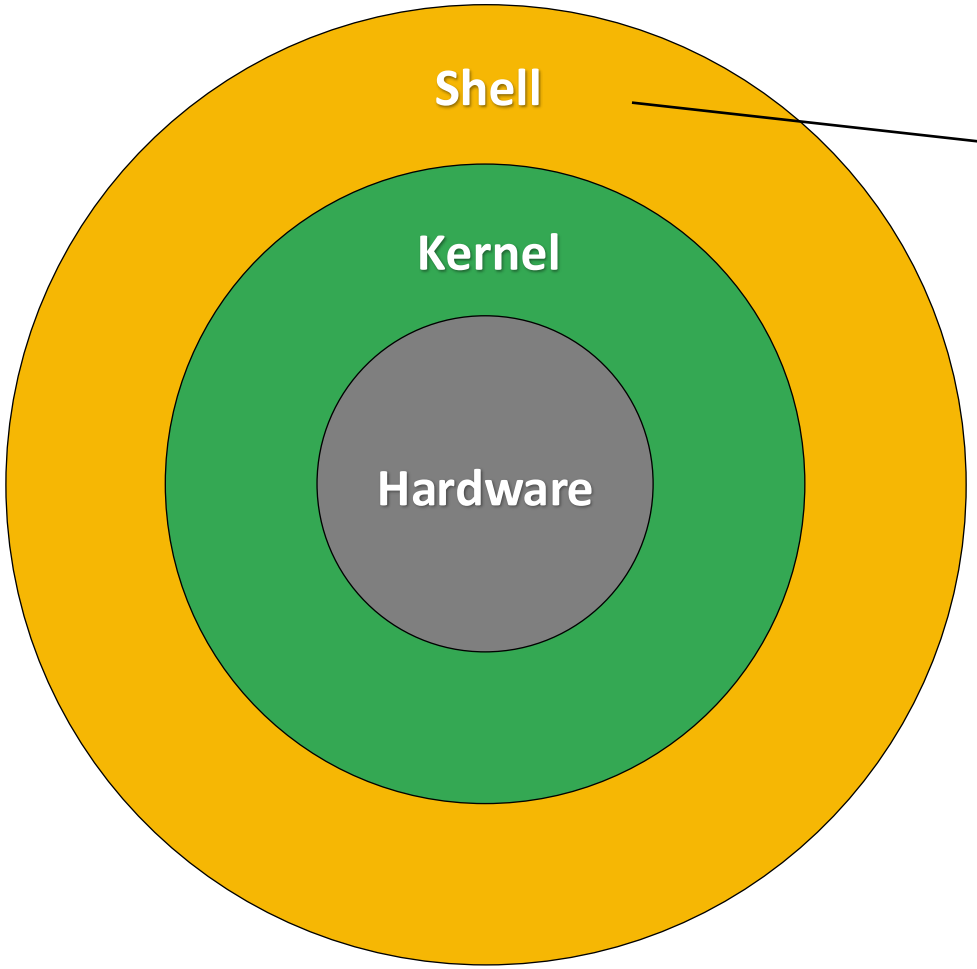
- Resource management
- Process management
- Device Drivers
- System Calls
- …

→ **Speaks: Machine**

The Shell



User

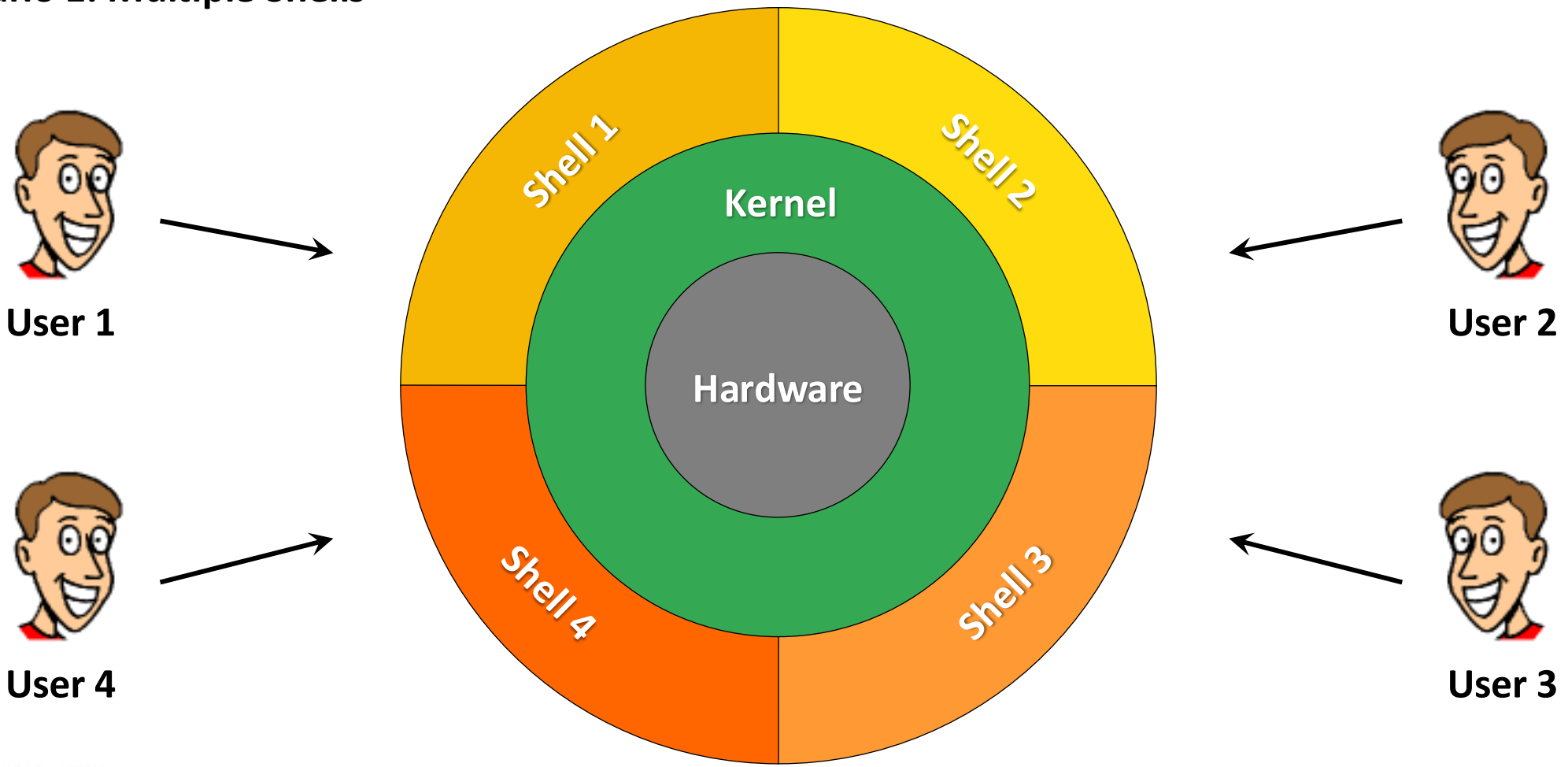


- Command execution
- Scripting
- …

→ **Speaks: Human**

What's Shell?

- **Scenario 1: Multiple Shells**



One Kernel, Many Shells



Every user gets their own Shell session

- → One kernel manages the whole machine
- → Each login (or job) spins up its own Shell
- → A Shell can even launch another Shell inside it — a subshell (more on this in Module 3)

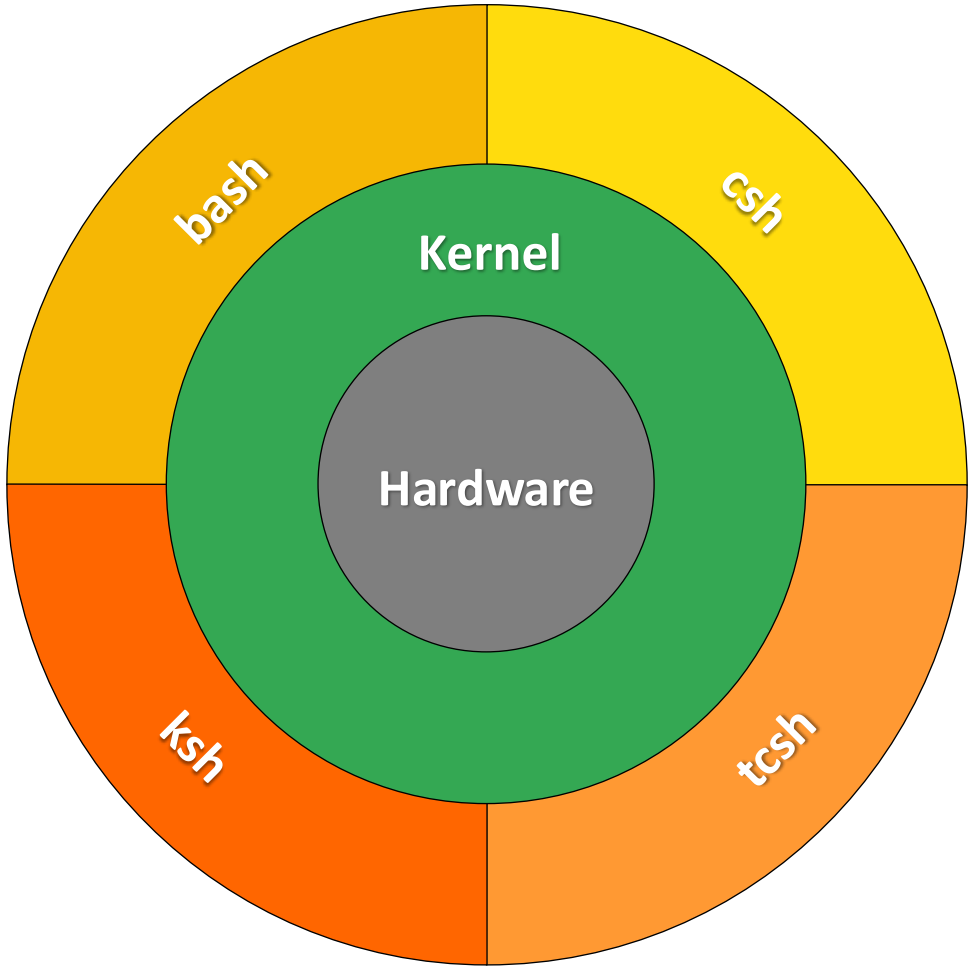
Working Definition

"Shell"

A user interface to access UNIX-like systems (e.g., Linux) by executing commands.

That's it — everything today builds on this one idea.

Many Shells, One Focus Today



Many Shells, One Focus Today

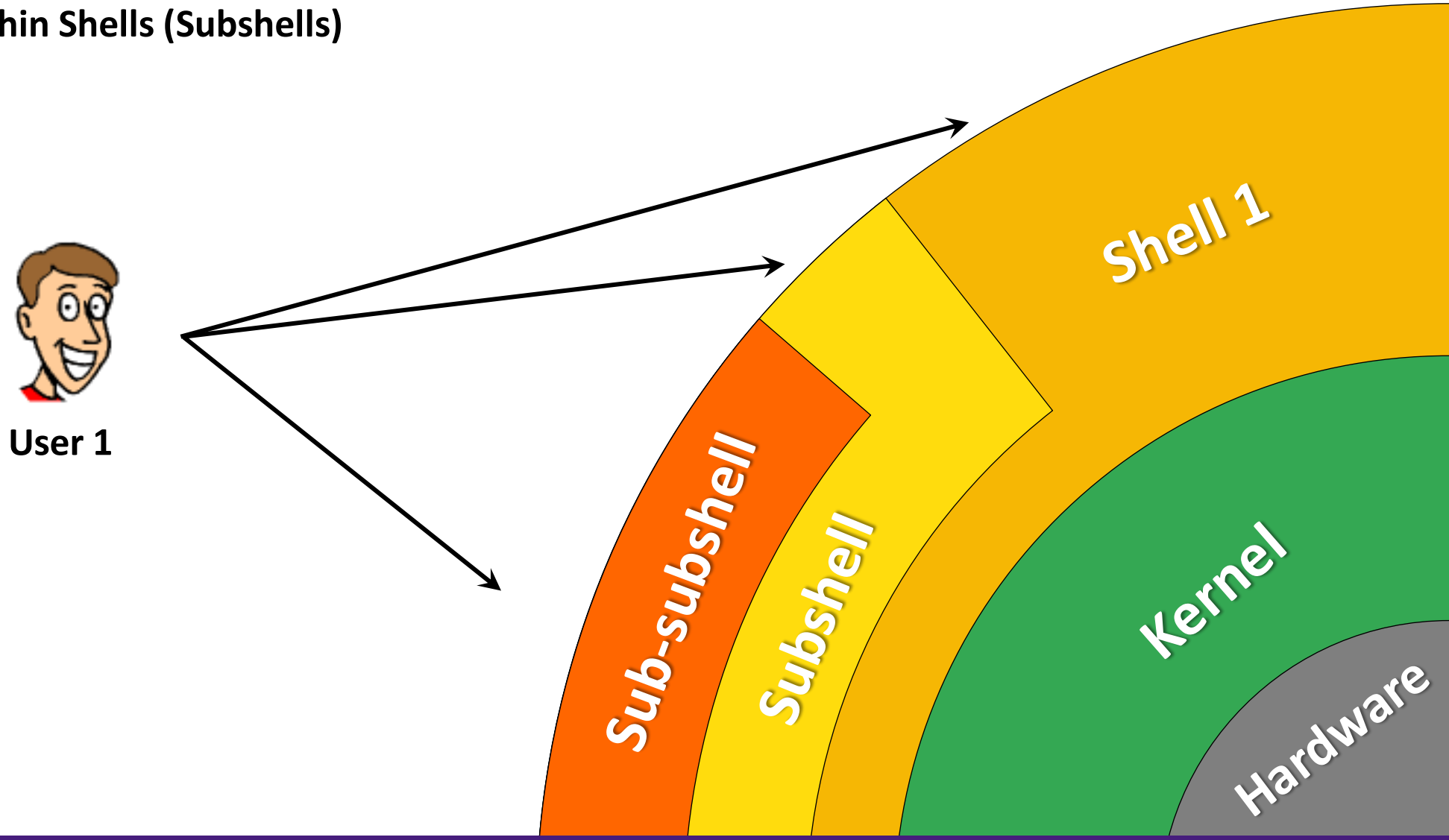
Most of these are supported on our clusters (except in RED) — use whichever you like and set your own default.

sh Original Bourne Shell /bin/sh	**bash** Bourne Again Shell /bin/bash	**csh** C Shell /bin/csh	**tcsh** TENEX C Shell /bin/tcsh
ksh KornShell /bin/ksh	**zsh** Z Shell — macOS default /bin/zsh	**dash** Debian Almquist Shell /bin/dash	**fish** Friendly Interactive Shell /bin/fish

bash is the default Shell on all LSU/LONI clusters — that's what we'll use for every example today.

1) What's Shell?

- **Scenario 2: Shells within Shells (Subshells)**



Outlines

1. **Introduction**
   1) What's Shell?
   2) What Shell Offers You?
2. **Basic Knowledge**
   1) Interactive vs Non-interactive (Shell Script)
   2) Basic Commands & Syntax
   3) Variables
   4) Arrays
   5) Arithmetic Operations
3. **Beyond Basics**
   1) Subshells
   2) Flow Control
   3) Advanced Text Processing Commands
4. **BONUS: Where to Get Help**

From One-Liners to Full Programs



Typing commands one by one

```
$ cd /work/$USER
$ ls -l
$ squeue -u $USER
```

Quick, simple, one task at a time.



...or a full automated script

```
#!/bin/bash
urls=("a.gz" "b.gz" "c.gz")
for f in "${urls[@]}"; do
  wget "$f" &
done
wait
echo "All downloads complete!"
```

parallelDownload.sh — a realistic mini-workflow

What Shell Offers You?

- **Shell Scripting:**
  - A practice to **automate tasks** with Shell commands.

What Shell Offers You?

$x

Variables

Store and reuse values, paths, and command output

{ }

Control Structures

if / elif / else for branching logic

↺

Loops

for, while — iterate over files, arrays, sequences

>_

Commands

Run any Linux command, pipe and redirect output

ƒ ( )

Functions

Reusable command blocks to keep scripts clean

≈

Text Processing

grep, sed — search and transform files at scale



Automation

Chain it all together to automate your HPC workflow

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What Shell Offers You?

$x

Variables

Store and reuse values, paths, and command output

{ }

Control Structures

if / elif / else for branching logic

↺

Loops

for, while — iterate over files, arrays, sequences

>_

Commands

Run any Linux command, pipe and redirect output

All of these work in both interactive terminals and batch job scripts.

ƒ ()

Functions

Reusable command blocks to keep scripts clean

≈

Text Processing

grep, sed — search and transform files at scale



Automation

Chain it all together to automate your HPC workflow

What Shell Offers You?

Shebang

Commands

Loops & Control Structures

```
#!/bin/bash

# ── Variables ──────────────────────────────────────
RESULTS_DIR="./outputs"
REPORT="summary.txt"

# ── Commands ───────────────────────────────────────
echo "Started: $(date)"
mkdir -p "$RESULTS_DIR"

# ── Function ───────────────────────────────────────
check_job() {
    grep -q "RESULT:" "$1" && return 0 || return 1
}

# ── Loop + Control Structure ───────────────────────
passed=0
for file in "$RESULTS_DIR"/job_*.out; do
    if check_job "$file"; then
        echo "[PASS] $file"
        passed=$((passed + 1))
    else
        echo "[FAIL] $file"
    fi
done

# ── Text Processing ────────────────────────────────
sed -i "s|/scratch/old|/work/project|g" "$RESULTS_DIR"/*.out
grep "RESULT:" "$RESULTS_DIR"/*.out > "$REPORT"

# ── Automation ─────────────────────────────────────
echo "$passed jobs passed. Report saved to $REPORT"
```

Variables

Functions

Grep & sed

What Shell Offers You?

Shebang

Commands

Loops & Control Structures

```
#!/bin/bash

# ── Variables ──────────────────────────────────────
RESULTS_DIR="./outputs"
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echo "Started: $(date)"
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check_job() {
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    fi
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# ── Text Processing ────────────────────────────────
sed -i "s|/scratch/old|/work/project|g" "$RESULTS_DIR"/*.out
grep "RESULT:" "$RESULTS_DIR"/*.out > "$REPORT"

# ── Automation ─────────────────────────────────────
echo "$passed jobs passed. Report saved to $REPORT"
```

Variables

Functions

Isn't it basically a programming language?

Grep & sed

Shell vs. “Real” Languages

Question	Why would I need...	...if I can just use
Everyday glue work	Shell	Python / C++ / Fortran?
Heavy computation	Python / C++ / Fortran	Shell?



a) Why Shell over another language?

Shell is a “quick and dirty” way to get things done. Example: replace “/ddnB/work” with “/work” in every file under ~/mycode/ — one sed one-liner beats a whole Python script.



b) Why another language over Shell?

Shell is highly inefficient for heavy calculation. A Pi-estimation benchmark in C finishes almost instantly; the same logic in Shell can take far longer.

Same Task, Two Approaches

Question	Why would I need…	…if I can just use
Everyday glue work	Shell	Python / C++ / Fortran?
Heavy computation	Python / C++ / Fortran	Shell?

Task: replace all occurrences of "/ddnB/work" with "/work" in every file under ~/mycode/ and its subfolders.

pathSwap.py

```
import os, re
for root,_,files in os.walk("mycode"):
  for fn in files:
    p = os.path.join(root, fn)
    s = open(p).read()
    s = s.replace("/ddnB/work","/work")
    open(p,"w").write(s)
```

pathSwap.sh

```
#!/bin/bash
find mycode -type f | xargs \
  sed -i 's|/ddnB/work|/work|g'
```

One line vs. seven — Shell wins for quick file & text manipulation.

Shell is a "**quick and dirty**" way to get things done!

Shell Is Not Built for Speed

Question	Why would I need...	...if I can just use
Everyday glue work	Shell	Python / C++ / Fortran?
Heavy computation	Python / C++ / Fortran	Shell?

Benchmark: estimating π to 10,000 iterations — same algorithm, two implementations.

```
[kasetti@qbd1 1.2-WhatCanShellDo]$ time ./pi_c 10000
niter=10000
count in circle:7852
Pi: 3.140800

real    0m0.003s
user    0m0.000s
sys     0m0.001s
```

```
[kasetti@qbd1 1.2-WhatCanShellDo]$ time ./pi_shell.sh 10000
niter=10000
count in circle:7866
Pi: 3.146400000000000000

real    1m7.762s
user    0m27.100s
sys     0m46.509s
```

Shell (100x+ slower)

Shell is **highly inefficient** for heavy calculation!

Rule Of Thumb

Anything you wish to run faster; you should NOT use shell!

What This Training Is (and Isn't)

Shell scripting is NOT for...

- Heavy calculation (anything you wish ran faster)
- Replacing a language / software you already know

Shell scripting IS for...

- Automating job workflows (env setup, calling executables)
- Pre/post-processing — trimming data, editing configs in batch

We do NOT expect you to...

- Be a Linux or Shell expert by end of today's training

We DO expect you to...

- Leave familiar with Shell's basic usage
- Be able to use it to optimize your job workflow

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Interactive vs Non-interactive Shell



Interactive

- → Runs in the terminal
- → You interact in real time
- → Type commands one by one
- → E.g., every time you log in



Non-Interactive (Script)

- → A pre-written script file
- → No interaction while running
- → Executes line-by-line, by itself

Interactive vs Non-interactive Shell

Interactive

```
[kasetti@qbd1 ShellScripting]$ ls
1.1-ShellExamples   2.1-InteractiveVsNonInteractive  2.5-Arithmetic  3.2-FlowControl
1.2-WhatCanShellDo  2.2-BasicCommands                3.1-Subshells   3.3-TextProcessing
[kasetti@qbd1 ShellScripting]$
[kasetti@qbd1 ShellScripting]$ date
Wed Feb 11 06:17:39 CST 2026
[kasetti@qbd1 ShellScripting]$
[kasetti@qbd1 ShellScripting]$ echo $SHELL
/bin/bash
[kasetti@qbd1 ShellScripting]$
[kasetti@qbd1 ShellScripting]$ cd 1.1-ShellExamples/
[kasetti@qbd1 1.1-ShellExamples]$
[kasetti@qbd1 1.1-ShellExamples]$ ls
countFiles.sh  helloworld.sh  parallelDownload.sh  pi_c  pi_c.sbatch
[kasetti@qbd1 1.1-ShellExamples]$
[kasetti@qbd1 1.1-ShellExamples]$ ./pi_c 10000000
niter=10000000
count in circle:7854959
Pi: 3.141984
[kasetti@qbd1 1.1-ShellExamples]$
```

Non-Interactive (Script)

```
#!/bin/bash

# Variables
DATA_DIR=$1
MAX_FILES=3
count=0

echo "Starting the script..."
echo "Looking for files in $DATA_DIR"

# Check if directory exists
if [[ ! -d $DATA_DIR ]]; then
  echo "Directory $DATA_DIR does not exist"
  exit 1
fi
```

shell scripting works the same way in both modes — a few features may differ slightly.

Anatomy of a Shell Script

helloworld.sh

```
#!/bin/bash

date
echo "Hello, HPC world!"
echo "Today is $(date)"
```

`#!/bin/bash`

The “shebang” — tells the system which Shell should run this script.

`date, echo …`

The commands to run, one per line — executed top to bottom, just like typing them interactively.

Don't forget - run “chmod u+x helloworld.sh” first so the file is executable.

[1] *ShellScripting/2.1-InteractiveVsNonInteractive/helloworld.sh*

Four Ways to Run a Script

	Method	Example	Remarks			
			Must be executable?	Which Shell?	Start subshell?	Others
1	**Use full path** (Most common)	`$ ./helloworld.sh` `$ /path/to/helloworld.sh`	√	**Shebang** (if exist) or **default** Shell	√	-
2	**Use specific Shell**	`$ bash helloworld.sh` `$ csh helloworld.sh`	×	**Specified** Shell	√	-
3	**Use "source" or "."**	`$ source helloworld.sh` `$ . helloworld.sh`	×	**Current** Shell	×	-
4	**Run as Shell command**	`$ helloworld.sh`	√	**Shebang** (if exist) or **default** Shell	√	Parent directory must be included in **$PATH** environment variable

Run "`chmod u+x [filename]`" if file is not executable

[1] *ShellScripting/2.1-InteractiveVsNonInteractive/helloworld.sh*

Quiz

- **What is this?**

➔ **Anything you learned about Shell today, applies to your batch job files!**

```
#!/bin/bash
#SBATCH -A loni_loniadmin1
#SBATCH -p single
#SBATCH -t 1:00:00
#SBATCH -N 1
#SBATCH -n 12

# Time stamp at the beginning
date

# Run the code
./pi_c 1000000

# Time stamp at the end
date
```

[1] *ShellScripting/2.1-InteractiveVsNonInteractive/pi_c.sbatch*

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Basic Commands Cheat Sheet

File

`ls` List files at a given path

`cp / mv` Copy / move files

`rm` Removes files

`find` Search for files

Directory

`cd` Change directory

`mkdir` Create a directory

`pwd` Print working directory

Display

`cat` Print entire file

`head / tail` First / last lines

`more / less` Page through a file

System

`echo` Print strings

`date` Current date & time

[1] https://www.hpc.lsu.edu/training/tutorials

Special Characters You'll Use Constantly

Character	Description	Example
#	**Comment**: Anything follows in the same line will not be executed.	`$ date # Print time stamp`
;	**Command separator**: Allows multiple commands in one line.	`$ module purge; module load python`
|	**Pipeline**: Use output of first command as input of the second.	`$ squeue -u $USER | wc -l`
>	**Redirect (Output)**: Redirect standard output / error to file. This method overwrites the file.	`$ ./testoutput > out.txt` `$ ./testoutput 1> out.txt 2> err.txt`
>>	**Redirect (Output)**: Redirect standard output / error to file. This method appends to the file.	`$ ./testoutput >> out.txt` `$ ./testoutput 1>> out.txt 2>> err.txt`
<	**Redirect (Input)**: Read input from a file instead of standard input.	`$ ./testinput < input.txt`
&	**Send to background**: Send a command to background, and do not wait for it to finish.	`$ sleep 10 &`

[1] *ShellScripting/2.2-BasicCommands/testoutput*
[2] *ShellScripting/2.2-BasicCommands/testinput*

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Variable Basics

	To assign	To access	To delete
Syntax	var=value	$var	unset var
Example	workdir="/work/$USER"	cd $workdir	unset workdir



3 Rules to Remember

- All Shell variables are strings — no int/float/bool type
- No spaces allowed around the “=” in assignment
- Use ${ } to explicitly mark a variable name, e.g. ${var}



Why the { } braces?

- Needed when text follows the variable directly
- e.g. echo "${var}_backup" vs. echo "$var_backup"
- Without braces, Shell reads a variable named var_backup

Variable Naming Rules

- Allowed characters: letters (a-z, A-Z), numbers (0-9), underscore (_)
- Must begin with a letter or underscore
- No other special characters (# @ % $ etc.)
- Case sensitive: VAR ≠ var



Allowed

```
varname
var_name
_varName
var123
```



Not Allowed

```
123var
#var
var@name
var-123
```

Local, Global & Environment Variables

	Local	Global
Syntax	var=value	export VAR=value
Scope	Exists only in current shell	Copied to all subshells
Convention	lowercase	UPPERCASE

Environment variables

Special (usually global) variables that Shell or other programs read to regulate behavior — change them with care.

Programs may have their own environment variables (e.g., Conda / Python / R / MPI …)

Local, Global & Environment Variables

Variable		Functionality
Shell	USER	Username.
	PWD	Full path to current directory.
	HOME	Full path to user's home directory.
	SHELL	Default Shell
	PATH	A list of paths to look for executables as Shell commands (separated by ":").
	LD_LIBRARY_PATH	A list of paths to look for shared libraries (separated by ":").
Slurm	SLURM_JOB_ID	Slurm job ID.
	SLURM_JOB_NODELIST	A list of nodes required for current job (useful for MPI).
OpenMP	**OMP_NUM_THREADS**	**Number of threads per process for OpenMP.**
…		

[1] https://www.hpc.lsu.edu/docs/slurm.php

Quotations & Variable Expansion

" "

Double quotes

Allows $variable expansion and command substitution; preserves everything else literally.

```
$ echo "echo $USER"
echo kasetti
```

' '

Single quotes

Preserves the literal value of ALL characters inside — no expansion at all.

```
$ echo 'echo $USER'
echo $USER
```

` `

Backticks

Command substitution — runs the command and substitutes its output. (Modern style: use $(...) instead — more slide ahead!)

```
$ echo `echo $USER`
kasetti
```

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Arrays: Collections of Values

Same basic logic as arrays in any language — indexed from 0, with a few Shell-specific twists.

	To assign	To access	To delete
Entire array	myAry=("Alice" "Bob" "Charlie")	echo ${myAry[@]}	unset myAry
One element	myAry[1]="Brian"	echo ${myAry[1]}	unset myAry[1]

Bonus: get array length with **`${#myAry[@]}`**

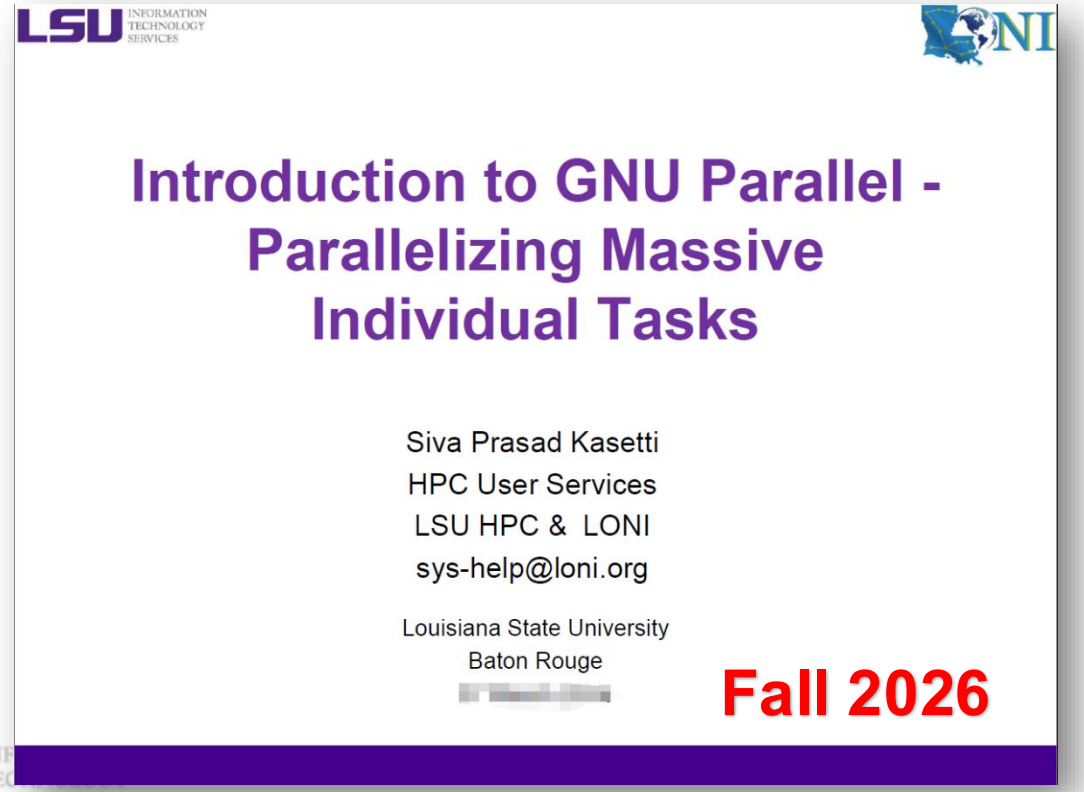


Real use case: parallel job submission

```
inputParams=("case1" "case2" "case3")
parallel myexec ::: ${inputParams[@]}
```

Arrays: Collections of Values

- **Question:**
  - I am not using Shell for heavy calculation anyways! What can I possibly need arrays for?




```
$ parallel myexec ::: ${inputParams[@]}
```

[1] https://www.hpc.lsu.edu/training/tutorials.php#upcoming

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Arithmetic Operations : Why We Still Need Them

- **Wait a minute!**
  - Didn't you say Shell does **not** support number type, and we should **not** use it for heavy calculation?
  - Correct!
  - But! Sometimes arithmetic is still needed.

What Does NOT Work?

- **What does NOT work:**

```
$ a=10
$ b=$a/3+2
$ echo $b      # what do you get?
10/3+2         # ...not math! just text.
```

[1] *ShellScripting/2.5-Arithmetic/bcExample.txt*

Four Ways to Perform Arithmetic

- **What DOES work** (assuming **a=10**):

	Method	Example	Remarks
1	**$((…))** (Most common)	$ echo $(($a/3+2))	• Evaluate **everything inside** the braces. • **Integers** only!

2	**let**
	(Slightly more advanced)
		$ let b=$a/3+2
		$ let b=a/3+2
		$ let b++
			• Evaluate **assignment** w/ arithmetic calculation.
			• "**$**" can be emitted.
			• **Integers** only!

3	**expr** (Legacy, most limited)	$ expr $a / 3 + 2	• Strictly limited to "**ARG1 OPERATION ARG2**" format. • **Integers** only!

4	**bc**
	(Most powerful)
		$ bc
		scale=3
		a=10;a/3+2
		$ bc < bcExample.txt
		$ echo "$a/2+3" | bc
			• **Interactive** and **non-interactive** mode.
			• Does **NOT** support Shell syntax (namely, "**$**" for variables).
			• Unassigned variables treated as **0**.
			• **scale** variable determines number of decimals.
			• Supports **float number**!

[1] *ShellScripting/2.5-Arithmetic/bcExample.txt*

Modern Best Practices

A few habits that weren't always emphasized in older Shell tutorials — worth adopting from day one.

Fail fast with set -euo pipefail

Add this near the top of scripts so errors, unset variables, and pipeline failures stop the script instead of silently continuing.

Prefer $(...) over backticks

$(command) nests cleanly and is easier to read than `command` — the modern standard for command substitution.

Lint with ShellCheck

shellcheck myscript.sh catches quoting bugs, unset variables, and portability issues before you run the script.

Quote your variables

Always write "$var" instead of $var to avoid word-splitting and glob surprises with paths that contain spaces.

Summary

- **In this section, we talked about:**

1) Interactive vs Non-interactive (Shell Script)
2) Basic Commands & Syntax
3) Variables
4) Arrays
5) Arithmetic Operations

Refresh

- Get some water
- Use restroom
- Ask questions

- Don’t forget, the examples are at:
  - https://www.hpc.lsu.edu/static/training/weekly-materials/Downloads/ShellScripting.zip

Outlines

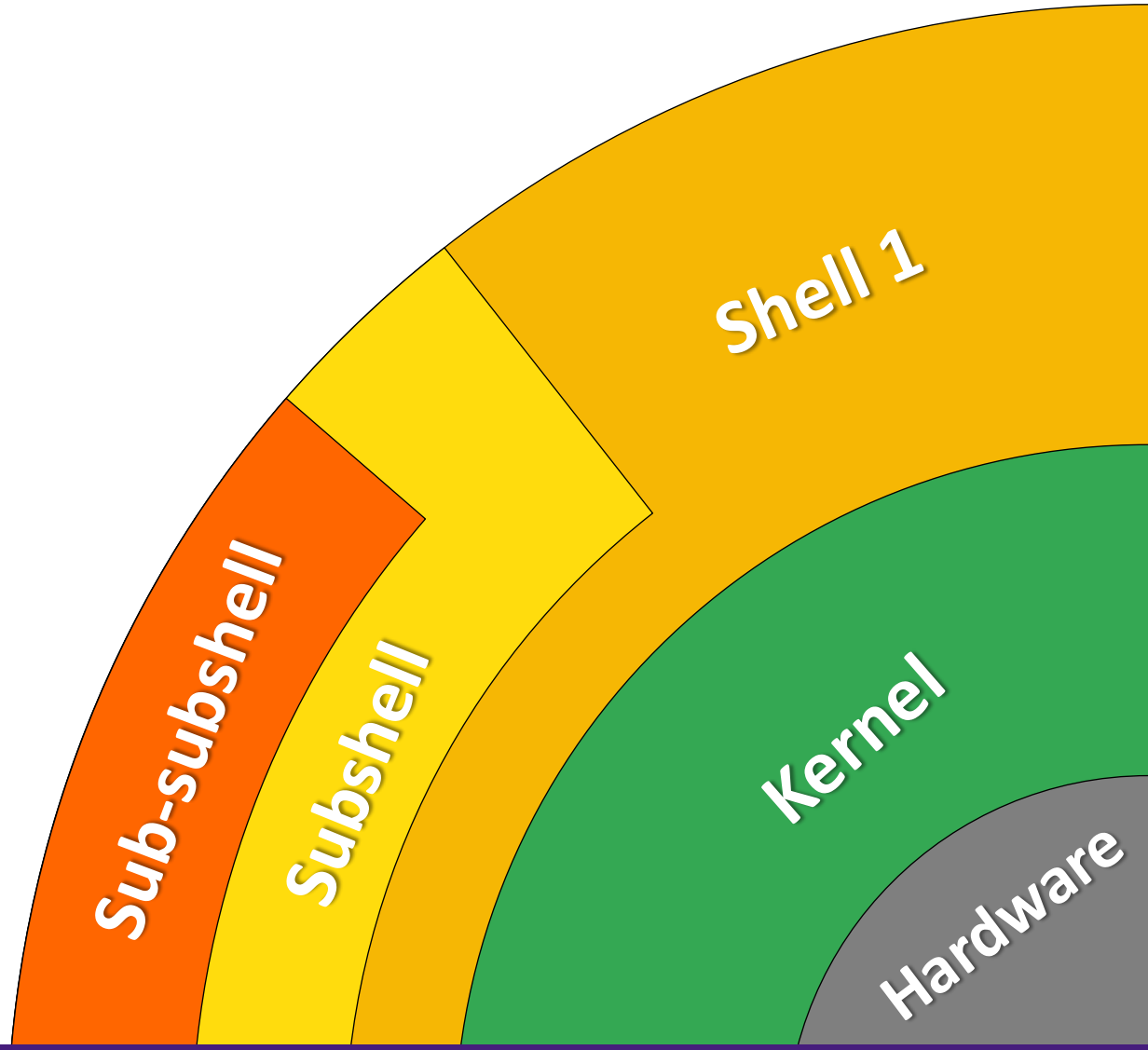
1. Introduction
   1) What's Shell?
   2) What can Shell do?
2. Basic Knowledge
   1) Interactive vs Non-interactive (Shell Script)
   2) Basic Commands & Syntax
   3) Variables
   4) Arrays
   5) Arithmetic Operations
3. **Beyond Basics**
   1) Subshells
   2) Flow Control
   3) Advanced Text Processing Commands
4. BONUS: Where to Get Help

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What is a Subshell?

- **Definition:**
  - A **child process** of launched by an existing shell.
- **Similarity:**
  - **Still a Shell**!
    (Everything we talked about works the same way!)
- **Difference:**
  - An **isolated** environment from its parent
    (A “sandbox” Shell)



How Are Subshells Created?

a) Launch a subshell

	Method	Example	Remarks
1	Run a Shell script	`$ ./subshell.sh` `$ bash subshell.sh`	• Can launch **different** Shell types • Check subshell level: **$SHLVL**
2	Explicitly launch an interactive subshell	`$ bash`	
3	Use command grouping "(…)"	`$ (echo "I am in subshell!")`	• Launches the **same** Shell type • Does **NOT** change $SHLVL

- What does **NOT** launch a subshell?
  - **source** subshell.sh
  - Commonly used for **environment setting** scripts (You WANT it to set up current Shell)
    - source setenv.sh

[1] *ShellScripting/3.1-Subshells/subshell.sh*
[2] *ShellScripting/3.1-Subshells/setenv.sh*

Variable Scope Across Shell Levels



	var="Hello" (local)	export var="Hello" (global)
Level 1 (defined here)	✓ Exists	✓ Exists
Level 2 (subshell)	✗ Does not exist	✓ Copied down
Level 3 (sub-subshell)	✗ Does not exist	✓ Copied down

Local variables stay put; exported (global) variables travel down into every subshell.

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Flow control

a) Condition – if statement

b) Loop – for loop

c) Loop – while loop

d) Functions

Condition: The if Statement

```
if [ condition ]; then
  # do something
elif [ condition2 ]; then
  # do something else
else
  # fallback
fi
```

Key Points

- → elif and else are both optional
- → Strict spaces required inside [condition]
- → Use [[ ]] for modern features — regex, logic operators, and more

Comparison	Integer	String
Equal / Not equal	[$a -eq 0] / [$a -ne 0]	[$a == $b] / [$a != $b]
Greater / Less than	[$a -gt 0] / [$a -lt 0]	—
Zero / non-zero length	—	[-z $a] / [-n $a]

File Tests & Logical Operators

File Test	Syntax
Exists	[-e myfile]
Is a regular file / directory	[-f myfile] / [-d /home/$USER]
Not zero size	[-s myfile]
Read / write / execute permission	[-r] / [-w] / [-x myfile]

Logic	[ ]	[[ ]]
NOT	[! -e myfile]	[[! -e myfile]]
AND	[-f a] && [-s a]	[[-f a && -s a]]
OR	[-f a] || [-f b]	[[-f a || -f b]]



[ ] single brackets

Supported by more Shells — use when you need portability across Shell types.



[[ ]] double brackets

Best supported by bash — use when you need versatility (regex, &&, ||).

Loop: for

```
for arg in “${myAry[@]}”
do
  # do something with $arg
done
```

Run the loop body once for each element in a list.

Source	Example
User-defined array	myAry=("Alice" "Bob"); for arg in ${myAry[@]}
Generated sequence	for arg in `seq 1 4`
Output of a command	for arg in `ls $HOME`



Try it: loop over your submitted jobs

```
for jobid in $(squeue -u $USER -h -o %A); do
  scontrol show job $jobid | grep RunTime
done
```

Loop: while

```
while [ condition ]
do
  # do something
done
```

```
counter=0
while [ $counter -lt 10 ]
do
  echo "Counter is now $counter"
  let counter++
done
```



Make sure there's always an escape condition.

If the condition never becomes false — e.g., you forget “let counter++” — the loop runs forever and your job never finishes. Always double-check the increment/exit logic before submitting.

[1] *ShellScripting/3.2-FlowControl/while.sh*

Reusable Code: Functions

```
# Define
function_name () {
  # do something
}

# Call – no parentheses
function_name arg1 arg2
```

Arguments are accessed as $1, $2 … ${10}, or $@ for all of them.

Remarks	Example
All variables are **global** by default	`$ myFunc1 () { var="Bob" } $ var="Alice"; myFunc1 ; echo $var`
Local variables must be explicitly declared	`$ myFunc2 () { local var="Bob" } $ var="Alice"; myFunc2 ; echo $var`
Does **NOT** support **return** (Use global variable if needed)	`$ myAdd () { result=$(($1+$2)) } $ myAdd 10 20 ; echo $result 30`

Flow control

- **Summary**

a) Condition – `if` statement

b) Loop – `for` loop

c) Loop – `while` loop

d) Functions

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Advanced Text Processing Commands

a) **grep** → search

b) **sed** → edit

grep: Syntax

a) **grep**

- **Search** for patterns (formatted strings) in **input stream** (**files** & **pipe**)

Syntax

```
$ grep <options> <search pattern> <files>
```

grep: Basic Functionality

Description	Example
Search for lines contain given string in a file	$ grep "Sales" employee1.txt
Search for lines do NOT contain given string in a file	$ grep -v "Sales" employee1.txt
Search all files for lines contain given string in the directory	$ grep "Sales" *
List files that do NOT contain given string in the directory	$ grep –L "Sales" *
Search for strings in a pipe	$ squeue | grep $USER

[1] *ShellScripting/3.3-TextProcessing/employee1.txt*
[2] *ShellScripting/3.3-TextProcessing/employee2.txt*

grep: Useful Options

a) grep

ii. Useful options

Option	Description
-i	Ignore cases.
-r,-R	Search recursively.
-v	Invert match (return those do NOT match pattern)
-l	List names of the files that match the pattern.
-L	List names of the files that do NOT match the pattern.
-n	Print line number with output lines.
…	

[1] https://man7.org/linux/man-pages/man1/grep.1.html

a) grep

iii. Pattern

- Can be as simple as strings.
- Can be **Regular Expression** (formatted strings to match beyond fixed strings).

Common Regular Expression Metacharacters

a) grep

iii. Pattern

Metacharacter		Matches	Example
Anchor	^	Beginning of a line.	^Name *(Beginning of a line followed by "Name")*
	$	End of a line.	Salary$ *("Salary" followed by end of a line)*
Substitution	.	Any single character	a.e *(E.g., "age", "ame", "a#e", "a1e",…)*
Repetition	*	Preceding char. repeats **0** or **more** times	50* *(E.g., "5", "50", "500",…)*
	+	Preceding char. repeats **1** or **more** times	50+ *(E.g., "50", "500",…)*
	?	Preceding char. repeats **0** or **1** times	50? *(E.g., "5", "50")*
	\{n,m\}	Preceding char. repeats **n** to **m** times	50\{1,3\} *(E.g., "50", "500", "5000")*
Or	[ ]	Any single character inside	[0-9] *(E.g., any single number character)*
	[^]	Any single character NOT inside	[^0-9] *(E.g., any single character but a number)*
	|	Either pattern	Sales|Technology *(E.g., "Sales" or "Technology")*
…			

sed: Introduction

b) sed

- A powerful “Stream editor” for **text transformation** on input stream (**files** & **pipe**)

Syntax

```
$ sed <options> <script> <files>
```

sed: Basic Functionality

All patterns support regular expression

Function	Usage	Description
Substitution	`$ sed 's/pattern/replacement/flags' file`	For each line, replace matched "pattern" with "replacement", and print out results.
	`$ sed 's/$[0-9]*/$9000/' employee2.txt`	Replace only the first match of each line.
	`$ sed 's/$[0-9]*/$9000/g' employee2.txt`	"Greedy" mode, replace all matches of each line.
Deletion	`$ sed '/pattern/d' file`	Delete lines with matched pattern, and print results.
	`$ sed '/Sales/d' employee2.txt`	Delete all lines matches "Sales".
	`$ sed '2,4d' employee2.txt`	Remove line 2 through 4.
Insertion	`$ sed '/pattern/ i\newline' file # Insert before` `$ sed '/pattern/ a\newline' file # Insert after`	Insert / Append new line at specific location, and print results.
	`$ sed '/Alice/ i\newline'`	Insert before lines matches "Alice".
	`$ sed '3 a\newline'`	Append to line 3.
…		

[1] *ShellScripting/3.3-TextProcessing/employee2.txt*

sed: Other Common Usage

b) sed

ii. Other common usage

Usage	Example	Description
$ sed –i <script> file	$ sed –i 's/$[0-9]*/$9000/' employee2.txt	Change file **in-place** instead of printing results.
$ sed –e <script1> –e <script2> file	$ sed –e 's/$[0-9]*/$9000/' \ –e 's/Rep/Assistant/' employee2.txt	Execute **multiple** scripts.
$ cmd | sed <options> <script>	$ conda env list | sed '/^#/d'	Parsing **piped output** instead of file.

[1] *ShellScripting/3.3-TextProcessing/employee2.txt*

Summary

grep searches, **sed** edits

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Bonus: Where to Get Help?

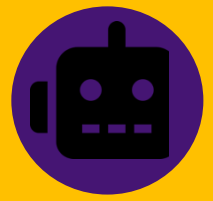
Two Places to Turn



1. HPC User Services

Email: sys-help@loni.org
Phone: +1 (225) 578-0900

Real humans who know our clusters, our storage, and your workflows.



2. Generative AI

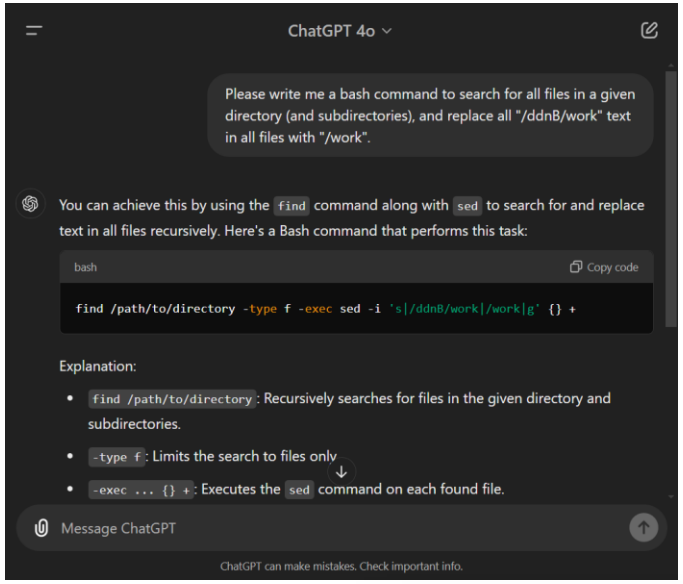
Claude, ChatGPT, GitHub Copilot — and MikeGPT, LSU's own assistant trained on LSU public data.

`mikegpt.lsu.edu`

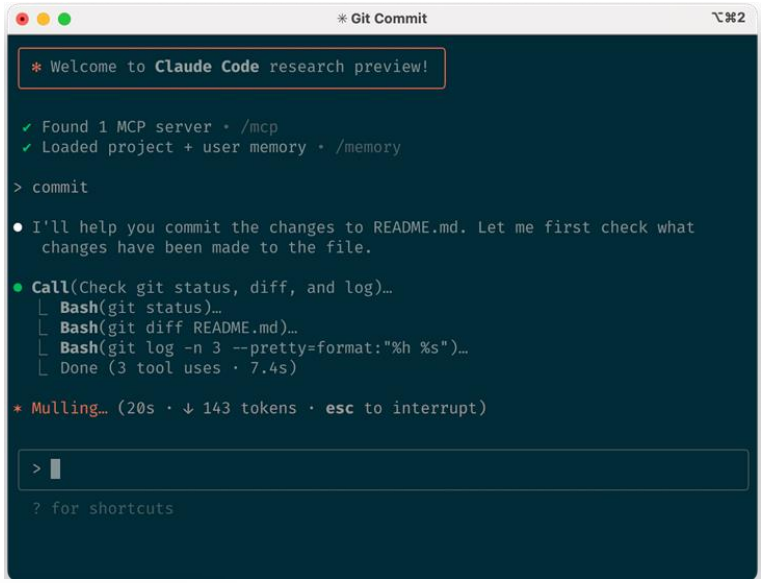
Great for quick, disposable snippets; not a replacement for understanding what the code does.

Two Places to Turn

ChatGPT

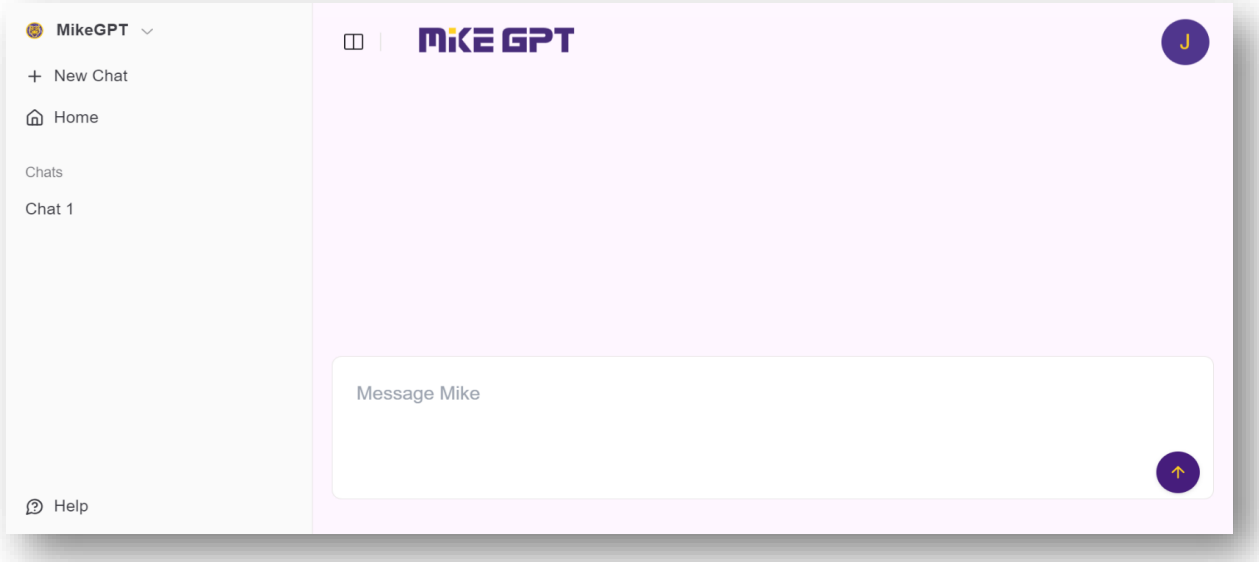


Claude



MikeGPT

(LSU's own GPT chat box! Trained with LSU public realm data)



LSU INFORMATION TECHNOLOGY SERVICES

Why AI Pairs Well With Shell Scripting?

Generative AI is…	Shell scripting needs…
Good at quick, “dirty” answers	A quick, dirty answer — that's often all you need
Not great at citing reliable sources	You rarely need a citation for a one-liner
Strong at short, focused code	One clean line, not a sprawling codebase



1. Ask the right question

Think through the task yourself first, then ask AI precisely.



2. TEST, TEST, TEST

Run it in a safe sandbox — especially if it's destructive.



3. Adopt into your workflow

Once verified, fold it into your real scripts and jobs.

What We Covered Today



Introduction

What Shell is, and its sweet spot vs. limits



Basic Knowledge

Commands, variables, arrays, arithmetic



Beyond Basics

Subshells, flow control, grep & sed



Bonus

HPC User Services + generative AI, done right



Take-Home Message

Anything you wish to

- ✓ **Run faster; you should NOT use Shell.**
- ✓ **Automate, pre(post) processing; you SHOULD use Shell.**

Thank You!

Questions welcome anytime — that's what we're here for.


sys-help@loni.org


+1 (225) 578-0900


hpc.lsu.edu/training



Keep Practicing

Download the exercises and try each example yourself on the cluster:

https://www.hpc.lsu.edu/static/training/weeklymaterials/Downloads/ShellScripting.zip