

# HIGH PERFORMANCE RESEARCH COMPUTING

## ACES: Introduction to Julia

HPRC Training

29 October 2024



High Performance  
Research Computing  
DIVISION OF RESEARCH



# Introduction to Julia: Outline



# Part I: A brief overview of Julia



**Julia** is a high-level general-purpose dynamic programming language primarily designed for **high-performance numerical analysis and computational science**.

- Born in MIT's Computer Science and Artificial Intelligence Lab in 2009
- Combined the best features of Ruby, MatLab, C, Python, R, and others
- First release in 2012
- Latest stable release v1.10.2 as of Mar 31, 2024
- <https://julialang.org/>
- customized for "greedy, unreasonable, demanding programmers"
- [Julia Computing](#) established in 2015 to provide commercial support



## Major features of **Julia**:

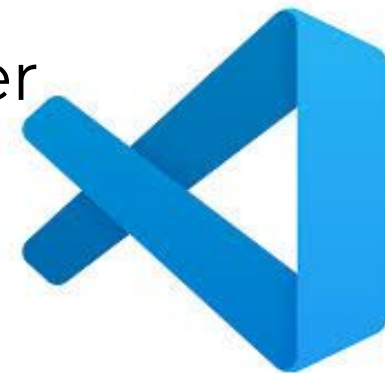
- **Fast**: designed for high performance
- **General**: supports different programming patterns
- **Dynamic**: dynamically-typed with good support for interactive use
- **Technical**: efficient numerical computing with a mathematics-friendly syntax
- **Optionally typed**: a rich language of descriptive data types
- **Composable**: Julia's packages naturally work well together

*"Julia is as programmable as Python while it is as fast as Fortran for number crunching. It is like **Python on steroids**."*

*--an anonymous Julia user on the first impression of Julia.*

# Where to Run Julia

- Juno IDE - developed for the Julia language (no longer under development)
- VSCode - extensions for Julia are actively being managed
- Jupyter Notebook
- Julia REPL
  - Run, Evaluate, Print, Loop
  - Interactive
  - Searchable history, tab-completion, keybindings, dedicated help and shell modes



[>\\_aces Shell Access](#)

OnDemand provides an integrated, single access point for all of your HPC resources.

## Message of the Day

### ACES Maintenance Status, October 10

The planned maintenance for the PCIe Gen5 composability fabrics has been completed. The PVCs in two Gen5 fabrics will remain unavailable until replacement components arrive tomorrow or next week.

### IMPORTANT POLICY INFORMATION

- **Unauthorized use of HPRC resources is prohibited and subject to criminal prosecution.**
- **Use of HPRC resources in violation of United States export control laws and regulations is prohibited.**
- **Sharing HPRC account and password information is in violation of State Law. Any shared accounts will be DISABLED.**
- **Authorized users must also adhere to ALL policies at: <https://hprc.tamu.edu/policies>**

!! WARNING: THERE ARE ONLY NIGHTLY BACKUPS OF USER HOME DIRECTORIES. !!

# Run the following commands to install the necessary packages:

```
$ mkdir $SCRATCH/.julia
$ ln -s $SCRATCH/.julia
$ module load Julia/1.10.2-linux-x86_64
$ julia
julia> ]
(v1.10) pkg> add IJulia
(v1.10) pkg> add PrettyTables
(v1.10) pkg> add Plots
(v1.10) pkg> add CSV
(v1.10) pkg> add XLSX
(v1.10) pkg> add DataFrames
(v1.10) pkg> add StatsPlots
```

Press backspace to exit the pkg manager and type `exit()` to quit Julia



# Accessing the HPRC ACES Portal

The screenshot shows the HPRC website header with the Texas A&M logo and the text "TEXAS A&M HIGH PERFORMANCE RESEARCH COMPUTING". The navigation menu includes links for Home, User Services, Resources, Research, Policies, Events, Training, About, and Portal. The Portal link is highlighted with a red box. A dropdown menu is open, showing options: Terra Portal, Grace Portal, FASTER Portal, FASTER Portal (ACCESS), ACES Portal (ACCESS) (highlighted with a red box), and Launch Portal (ACCESS). On the left, there are sections for Quick Links and User Guides. The main content area features a large image of a server rack and a diagram illustrating a biological process involving Plasmid DNA, a cell, and a nucleus.

Quick Links

- New User Information
- Accounts
  - Apply for Accounts
  - Manage Accounts
- User Consulting
- Training
- Knowledge Base
- Software
- FAQ

User Guides

- ACES
- FASTER
- Grace
- Terra

Plasmid DNA

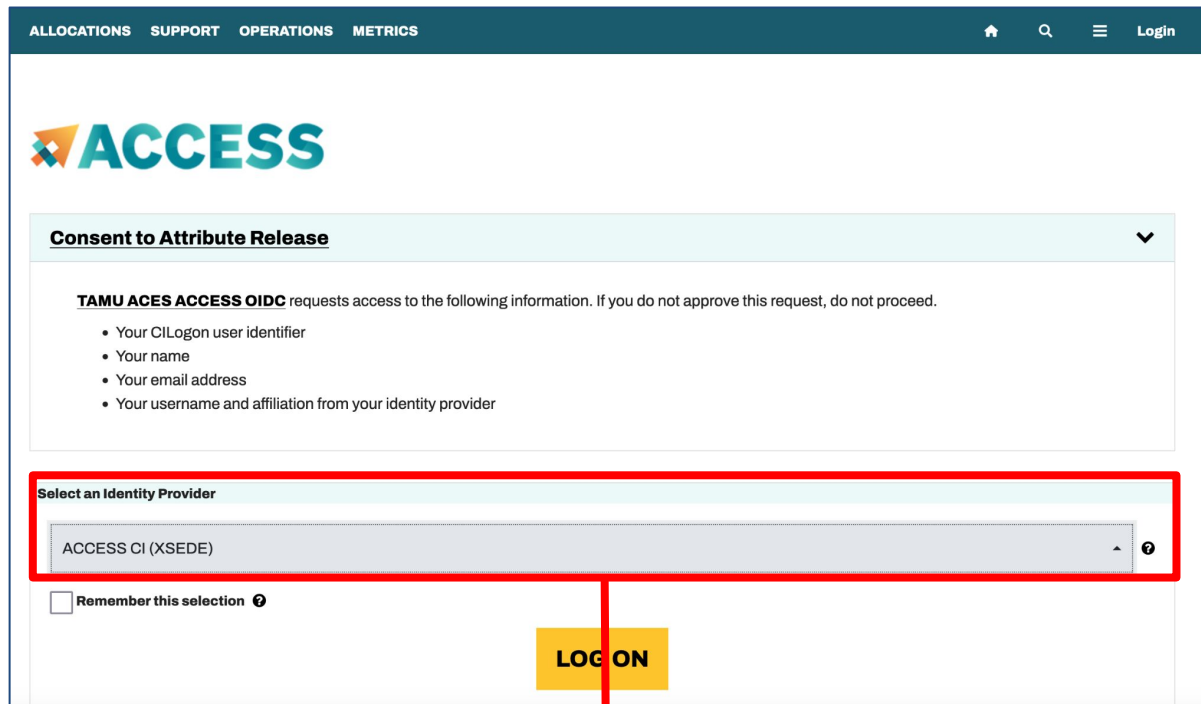
Nucleus

Cell

HPRC webpage: [hprc.tamu.edu](http://hprc.tamu.edu)



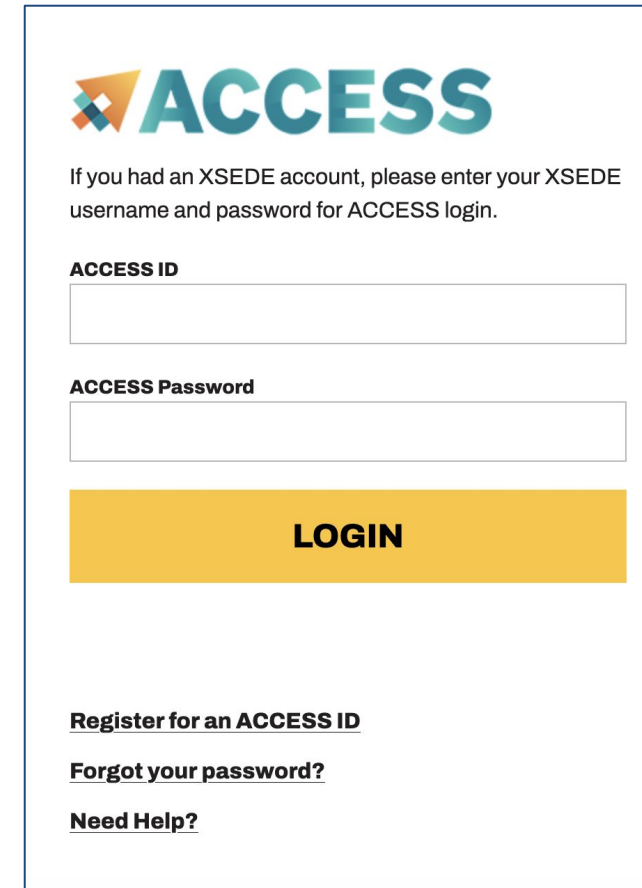
# Accessing ACES via the Portal (ACCESS)



The screenshot shows the ACCESS portal interface. At the top is a navigation bar with links for ALLOCATIONS, SUPPORT, OPERATIONS, and METRICS, along with a home icon, a search icon, a menu icon, and a Login link. Below the navigation bar is the ACCESS logo. A section titled "Consent to Attribute Release" contains a message from TAMU ACES ACCESS OIDC and a list of requested attributes: CILogon user identifier, name, email address, and username/affiliation. Below this is a "Select an Identity Provider" section with a dropdown menu showing "ACCESS CI (XSEDE)". A red box highlights this dropdown and the "Remember this selection" checkbox. A yellow "LOG ON" button is positioned below the dropdown. A red line points from the "LOG ON" button to the text below.

Select the Identity Provider appropriate for your account.

Log-in using your ACCESS credentials.



This screenshot shows the login section of the ACCESS portal. It features the ACCESS logo and a message: "If you had an XSEDE account, please enter your XSEDE username and password for ACCESS login." Below this are two input fields: "ACCESS ID" and "ACCESS Password". A large yellow "LOGIN" button is centered below the fields. At the bottom, there are three links: "Register for an ACCESS ID", "Forgot your password?", and "Need Help?".

[>\\_aces Shell Access](#)

OnDemand provides an integrated, single access point for all of your HPC resources.

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OnDemand provides an

## Message of the D

### ACES Maintenance

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### IMPORTANT POLIC

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#### GUI

VNC

NextSilicon VNC

#### Imaging

CryoSPARC

ImageJ

Jmol

Paraview

cisTEM

#### Servers

Jupyter Notebook

JupyterLab

RStudio (Short Course)

RStudio

TensorBoard

Tutorials OnDemand

point for all of your HPC resources.

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## Tutorials OnDemand version: 6ed5e37

This app will launch Tutorials OnDemand on the [ACES cluster](#).

What tutorial would you like to access?

Introduction to Julia

Number of hours (max 10)

3

Email

This field is optional.

Launch

\* The Tutorials OnDemand session data for this session can be accessed under the [data root directory](#).

Select "Introduction to Julia" from the dropdown menu

Set number of hours to 3

Click "Launch"

## Tutorials OnDemand (280791)

1 node | 2 cores | Running

Host: >\_ac009

Created at: 2024-10-28 09:04:21 CDT

Time Remaining: 2 hours and 57 minutes

Session ID: bc632df9-70c2-43b8-a9a9-6fa03546a5fa

Delete

Connect to Tutorials OnDemand: Introduction to Julia

jupyter

File Edit View Run Kernel Settings Help

Not Trusted

Open in... No Kernel

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julia

### Introduction to Julia

Julia is an open source, general purpose programming language designed to combine the speed and performance of lower-level languages (like C and Fortran) with user-friendly syntax found in dynamic, higher-level programming languages. It is especially well-suited for tasks like visualization, large data analytics, and parallel computing. It can be run dynamically via interactive REPL sessions or written, compiled, and run statically. Julia is an ideal choice for researchers and data scientists that prefer the benefits of dynamic programming but still need to solve large computational calculations or numerical simulations with the speed of statically-typed languages.

### Running the Julia REPL on the Command Line

After installation, Julia can be launched on the command line by typing `julia` (this will launch the interactive REPL) and can be quit using `exit()` or by typing `Ctrl+d`. You can switch to **shell mode** by typing a semicolon and **help mode** by typing a question mark.

### Running the Julia REPL on the Command Line

KEYBINDING	DESCRIPTION
Ctrl + d	Exit (when buffer is empty)
Ctrl + c	Interrupt or cancel



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<https://hprc.tamu.edu>

HPRC Helpdesk:

help@hprc.tamu.edu

Phone: 979-845-0219

*Please take our short course  
survey!*



HPRC Survey

[https://u.tamu.edu/hprc\\_shortcourse\\_survey](https://u.tamu.edu/hprc_shortcourse_survey)

Help us help you. Please include details in your request for support, such as, Cluster (Faster, Grace, ACES, Launch), NetID (UserID), Job information (Job id(s), Location of your jobfile, input/output files, Application, Module(s) loaded, Error messages, etc), and Steps you have taken, so we can reproduce the problem.

