

HIGH PERFORMANCE RESEARCH COMPUTING

ACES: Introduction to Julia

HPRC Training

18 March 2025



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 v1.11.4 as of Mar 10, 2025
- <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
- More information: <https://hprc.tamu.edu/kb/Software/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". Social media icons for Twitter, YouTube, and Facebook are in the top right. The navigation menu includes "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 from "Portal", listing "Terra Portal", "Grace Portal", "FASTER Portal", "FASTER Portal (ACCESS)", "ACES Portal (ACCESS)" (highlighted with a red box), and "Launch Portal (ACCESS)".

Quick Links

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

User Guides

- ACES
- FASTER
- Grace
- Terra

The main content area features a large image of server racks and a diagram illustrating a biological process. The diagram shows a 3D molecular structure on the left, a plasmid DNA molecule in the center, and a cell with a nucleus on the right. Arrows indicate the flow from the molecular structure to the plasmid DNA, and then to the cell. The text "Plasmid DNA" is written below the central image. The cell is labeled "Cell" and the nucleus is labeled "Nucleus".

HPRC webpage: hprc.tamu.edu

[>_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>**

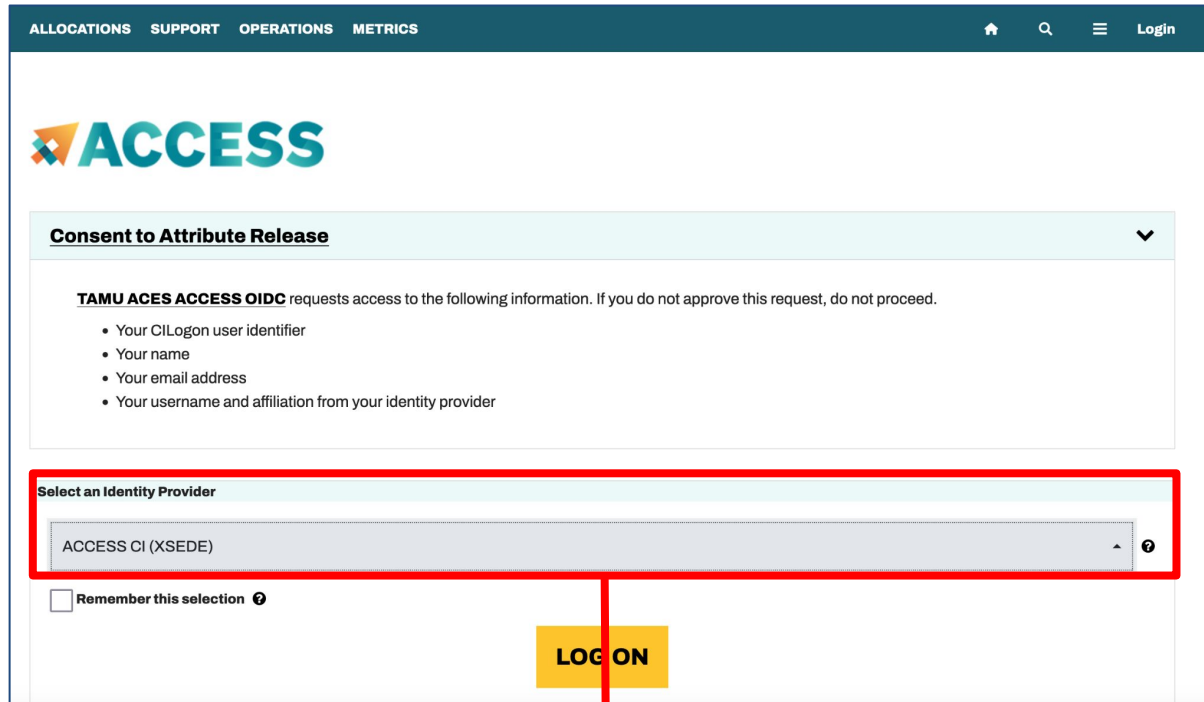
!! WARNING: THERE ARE ONLY NIGHTLY BACKUPS OF USER HOME DIRECTORIES. !!

Run the following commands to install the necessary packages:

```
$ mkdir $SCRATCH/.julia
$ ln -s $SCRATCH/.julia
$ module load Julia/1.11.4-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

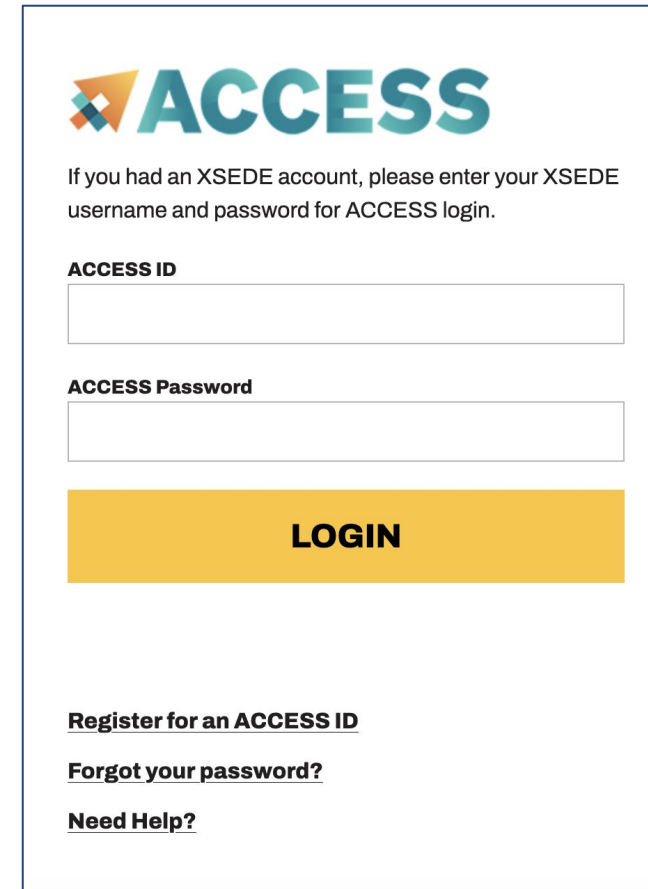
Accessing ACES via the Portal (ACCESS)



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" with a dropdown arrow contains a message from TAMU ACES ACCESS OIDC requesting access to user information. A list of requested attributes includes: Your CILogon user identifier, Your name, Your email address, and Your username and affiliation from your identity provider. Below this is a "Select an Identity Provider" section with a dropdown menu showing "ACCESS CI (XSEDE)". A red rectangle highlights this dropdown menu. Below the dropdown is a checkbox labeled "Remember this selection" with an information icon. At the bottom of the form is a yellow "LOG ON" button. 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.



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



OnDemand provides an

Message of the D

ACES Maintenance

The planned maintenance for
components arrive tomorrow

IMPORTANT POLIC

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- Use of HPRC resource
- Sharing HPRC account
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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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export control laws and regulations is prohibited.

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

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

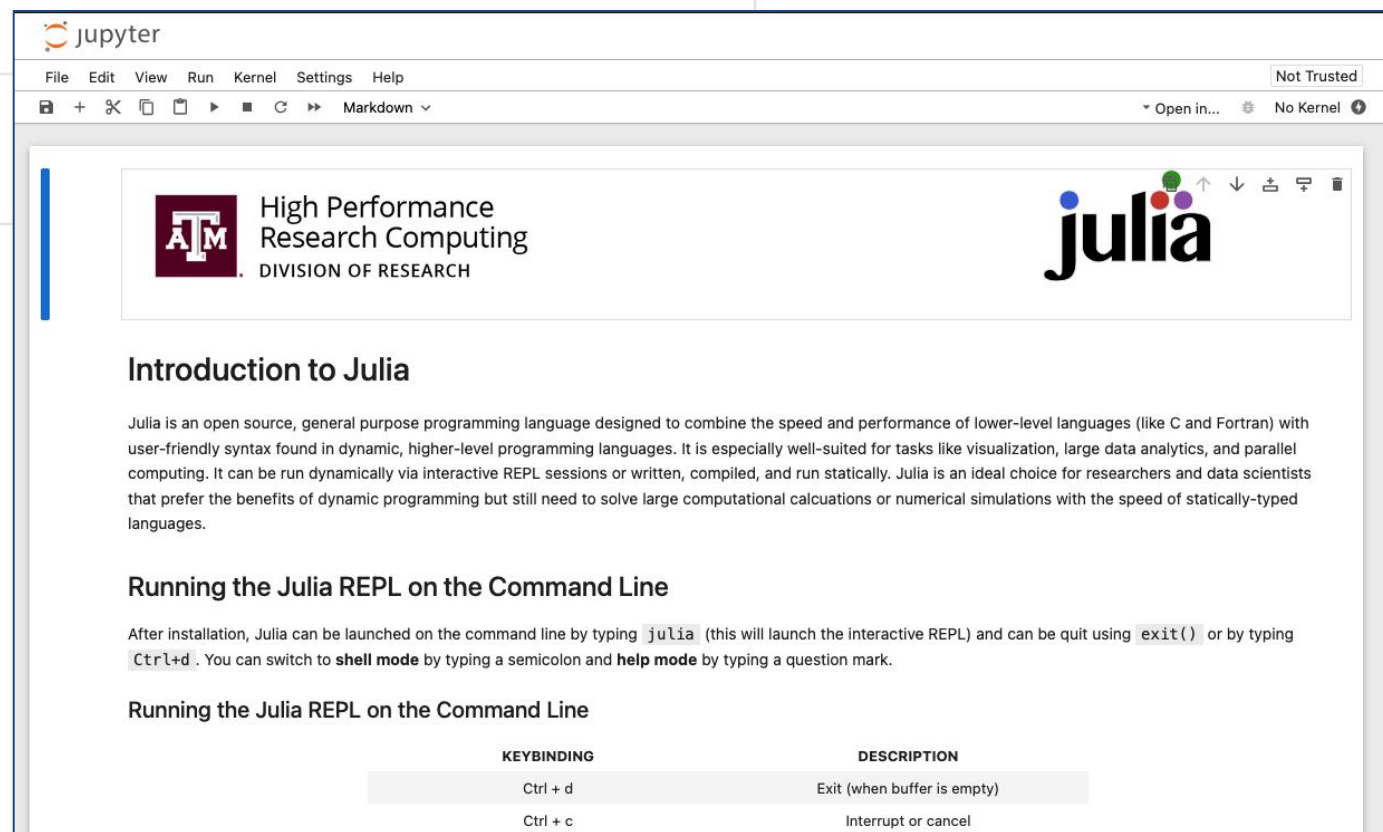
Created at: 2024-10-28 09:04:21 CDT

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



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 executed as a standalone application. For those who value the benefits of dynamic programming but still need to solve large computational problems, Julia provides a powerful and flexible environment.

After installation, Julia can be launched on the command line by typing `julia` (this will launch the REPL). You can switch to **shell mode** by typing a semicolon and **help mode** by typing a

KEYBINDING

Ctrl + d

Ctrl + c



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Julia is an open source, general purpose programming language with a user-friendly syntax found in dynamic, higher-level languages like Python and MATLAB, but with the performance of compiled computing. It can be run dynamically via an interpreter, but it also has the ability to compile that prefer the benefits of dynamic programming languages.

After installation, Julia can be launched on the command line by typing `Ctrl+d`. You can switch to **shell mode** by typing

Select Kernel

Start Preferred Kernel

✓ Python 3 (ipykernel)

Use No Kernel

No Kernel

Start Other Kernel

Julio 1102

Julia 1.11.4

Use Kernel from Preferred Session

Use Kernel from Other Session

IntroductionToJulia.ipynb



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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

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.

