

HIGH PERFORMANCE RESEARCH COMPUTING

ACES: Introduction to Julia

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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 v1.12.6
- <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.

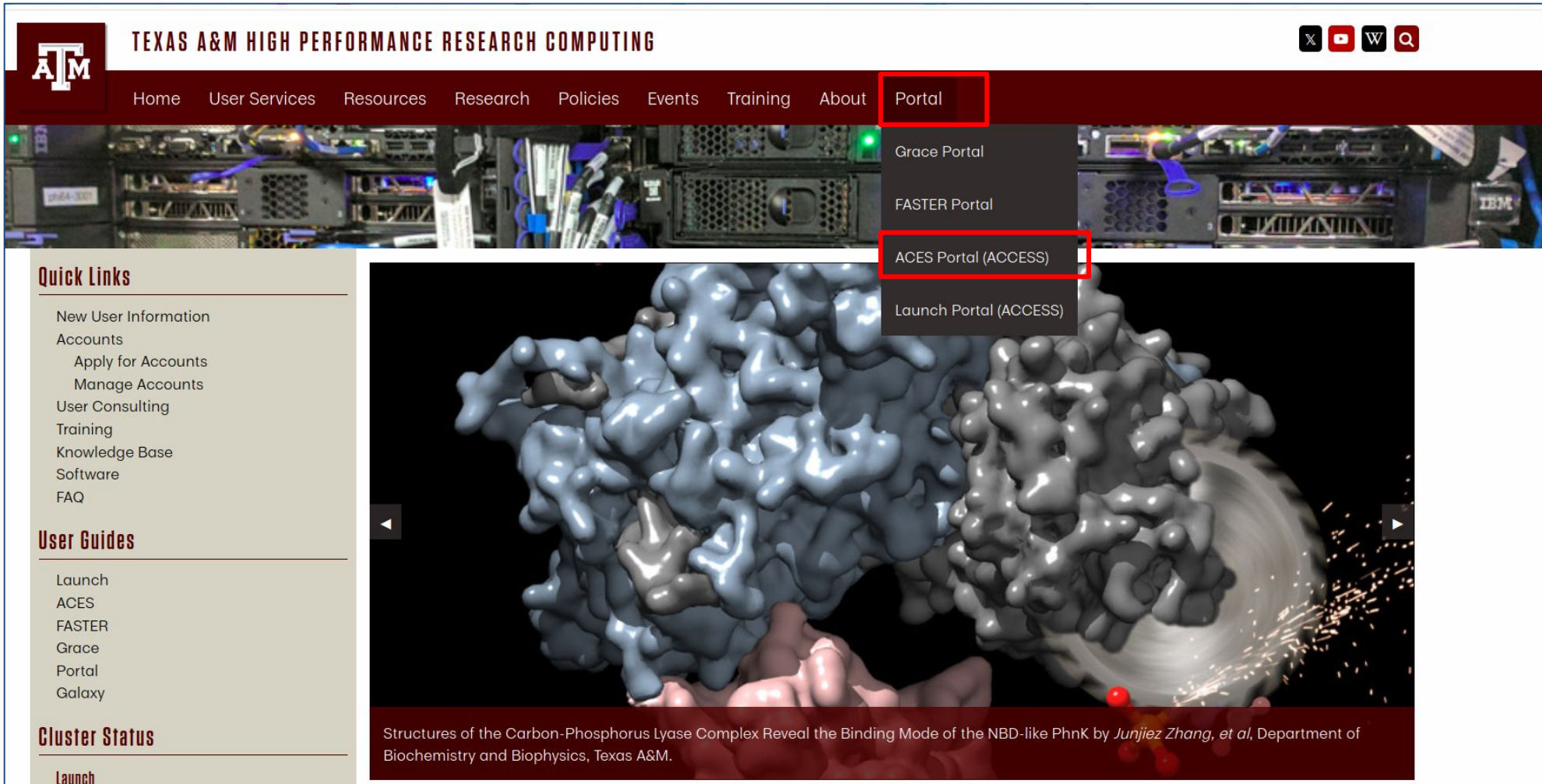
Where to Run Julia

- 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 displays the HPRC website interface. At the top left is the AT&M logo, followed by the text "TEXAS A&M HIGH PERFORMANCE RESEARCH COMPUTING". To the right are social media icons for Twitter, YouTube, and LinkedIn, along with a search icon. A navigation menu includes "Home", "User Services", "Resources", "Research", "Policies", "Events", "Training", "About", and "Portal". The "Portal" menu is open, showing options: "Grace Portal", "FASTER Portal", "ACES Portal (ACCESS)", and "Launch Portal (ACCESS)". The "ACES Portal (ACCESS)" option is highlighted with a red box. On the left side, there are sections for "Quick Links" (including New User Information, Accounts, User Consulting, Training, Knowledge Base, Software, and FAQ) and "User Guides" (including Launch, ACES, FASTER, Grace, Portal, and Galaxy). Below these is a "Cluster Status" section with a "Launch" link. The main content area features a large 3D molecular model of a protein complex, with a caption below it: "Structures of the Carbon-Phosphorus Lyase Complex Reveal the Binding Mode of the NBD-like PhnK by Junjiez Zhang, et al, Department of Biochemistry and Biophysics, Texas A&M."

HPRC webpage: hprc.tamu.edu



>_ acs Shell Access

🔍 System Status

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

Message of the Day

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.

SCRATCH IS NOT BACKED UP AND IS NOT MEANT FOR LONG TERM STORAGE.

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.



OnDemand provides an

Message of the D

ACES Maintenance

The planned maintenance for components arrive tomorrow

IMPORTANT POLIC

- **Unauthorized use of H**
- **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

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

Tutorials OnDemand

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

What tutorial would you like to access?

Select "Introduction to Julia" from the dropdown menu

Number of hours (max 10)

Set number of hours to 3

I would like to use select an account to use (leave unchecked to use default)

I would like to receive an email when the session starts

Advanced Options

Click "Launch"

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

Tutorials OnDemand (280791)

1 node | 2 cores | Running

Host: >_ac009

Delete

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

Time Remaining: 2 hours and 57 minutes

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

Connect to Tutorials OnDemand: Introduction to Julia

The screenshot shows a JupyterLab interface with a document titled "Introduction to Julia". The document content includes the following sections:

- High Performance Research Computing** (DIVISION OF RESEARCH) logo and the **julia** logo.
- Introduction to Julia**: A paragraph describing Julia as 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**: A paragraph stating that 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**: A table with two columns: **KEYBINDING** and **DESCRIPTION**.

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



Introduction to Julia

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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 REPL). 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

Ctrl + d

Ctrl + c



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Select Kernel

Start Preferred Kernel

✓ Python 3 (ipykernel)

Use No Kernel

No Kernel

Start Other Kernel

Julia 1.10.2

Julia 1.11.4

Use Kernel from Preferred Session

Use Kernel from Other Session

IntroductionToJulia.ipynb



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RESEARCH COMPUTING**
TEXAS A&M UNIVERSITY

<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.

