

Supercharge your data analysis with Biowulf

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High Performance Computing Services

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National Institutes of Health

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Outline

1. High-performance computing (HPC) overview
2. NIH HPC Systems
3. Support provided by HPC group
4. Q & A

Overview of high-performance computing (HPC)

High Performance Computing most generally refers to the practice of aggregating computing power in a way that delivers much higher performance than one could get out of a typical desktop computer or workstation in order to solve large problems in science, engineering, or business.

Source: <https://www.usgs.gov/advanced-research-computing>

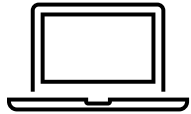
Overview of high-performance computing (HPC)

Personal computer



Overview of high-performance computing (HPC)

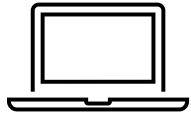
Personal computer



16GB Memory (RAM)

Overview of high-performance computing (HPC)

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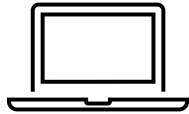


16GB Memory (RAM)

1 CPU (4 cores)

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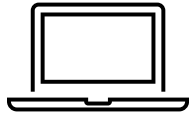
16GB Memory (RAM)

1 CPU (4 cores)

Disk space 512GB

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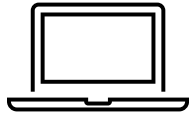
1 CPU (4 cores)

Disk space 512GB

1 GPU

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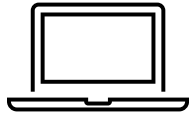
Disk space 512GB

1 GPU

Dedicated to one user

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16GB Memory (RAM)

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Dedicated to one user

HPC "Cluster"



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Dedicated to one user

HPC "Cluster"

Compute
"Nodes"



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Dedicated to one user

HPC "Cluster"

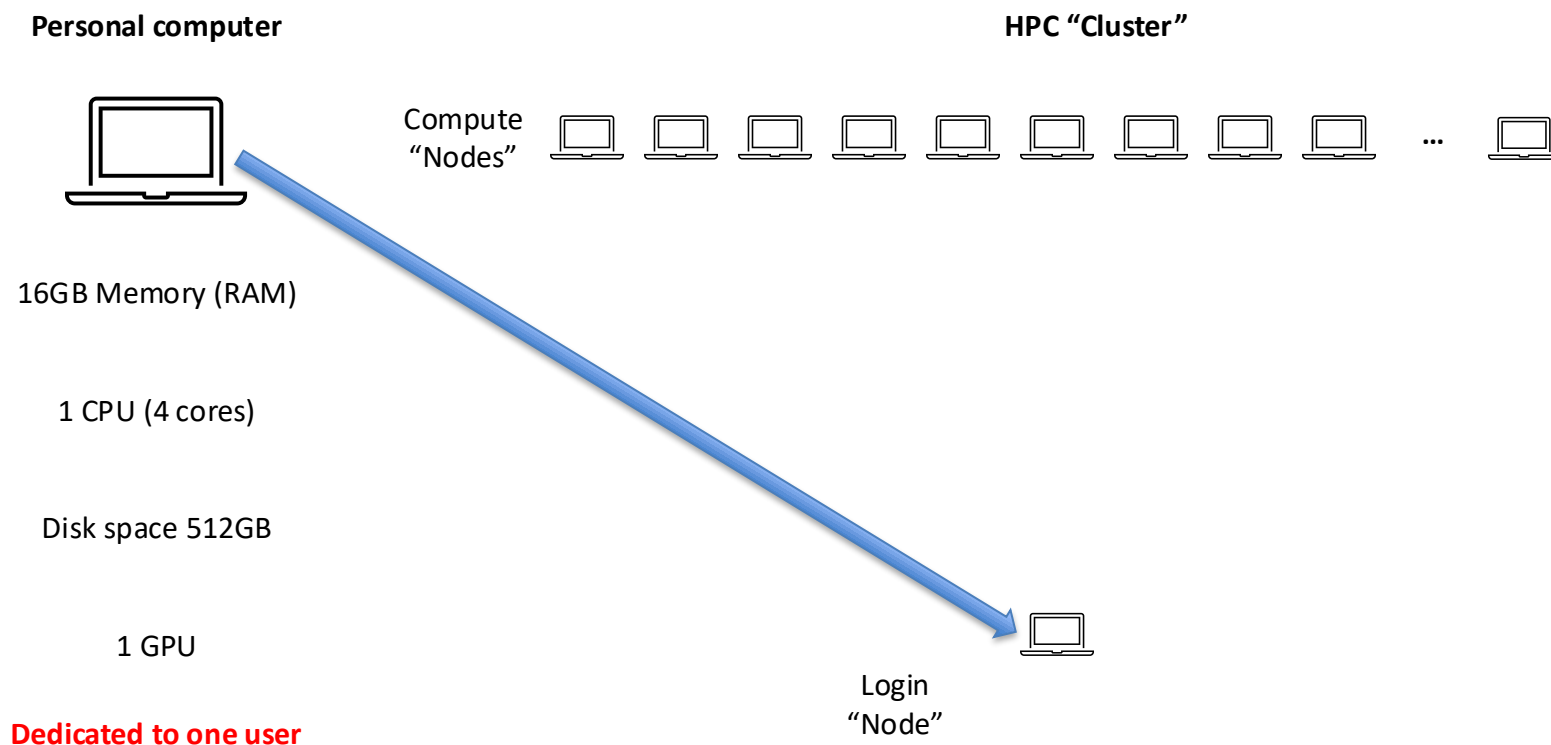
Compute
"Nodes"



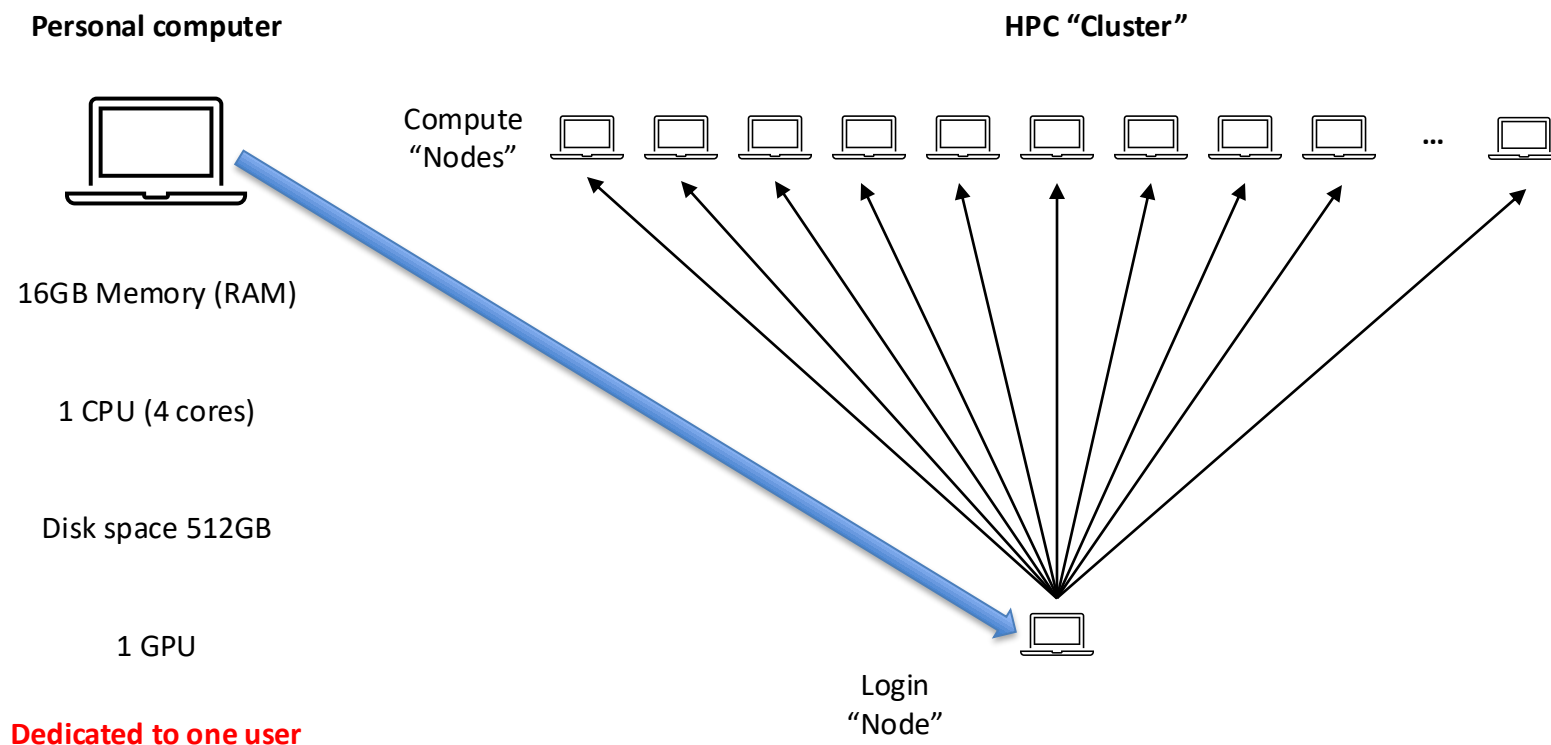
Login
"Node"



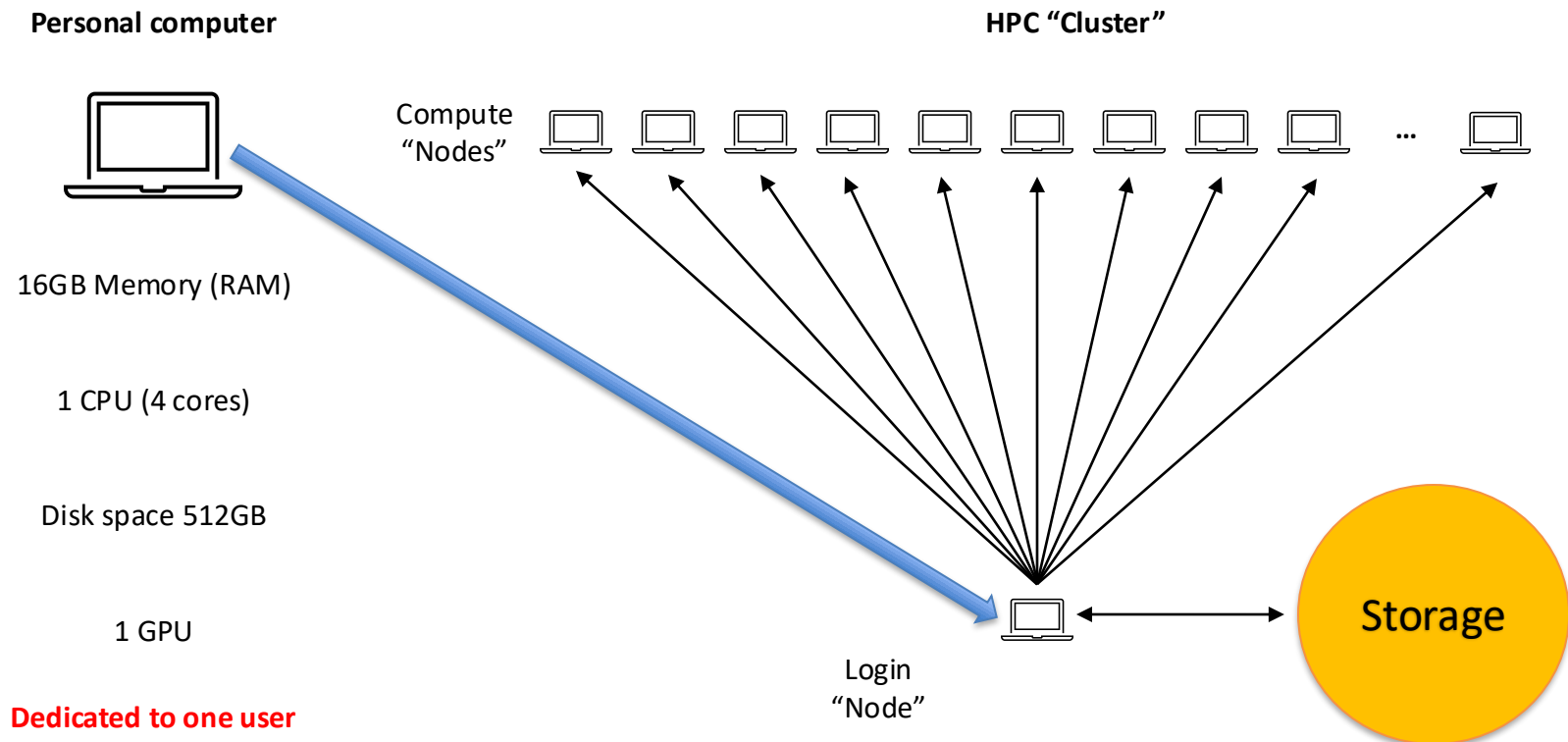
Overview of high-performance computing (HPC)



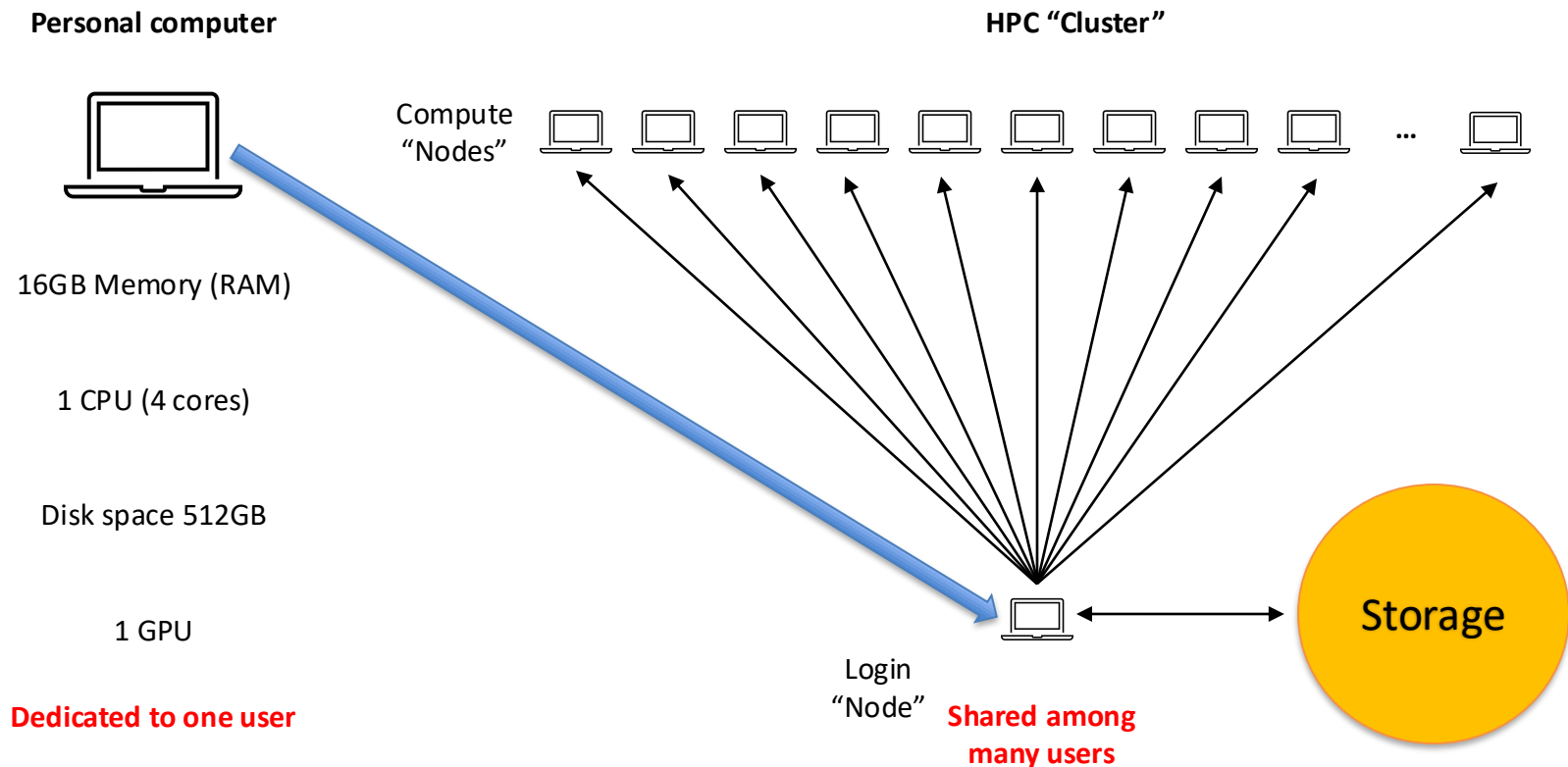
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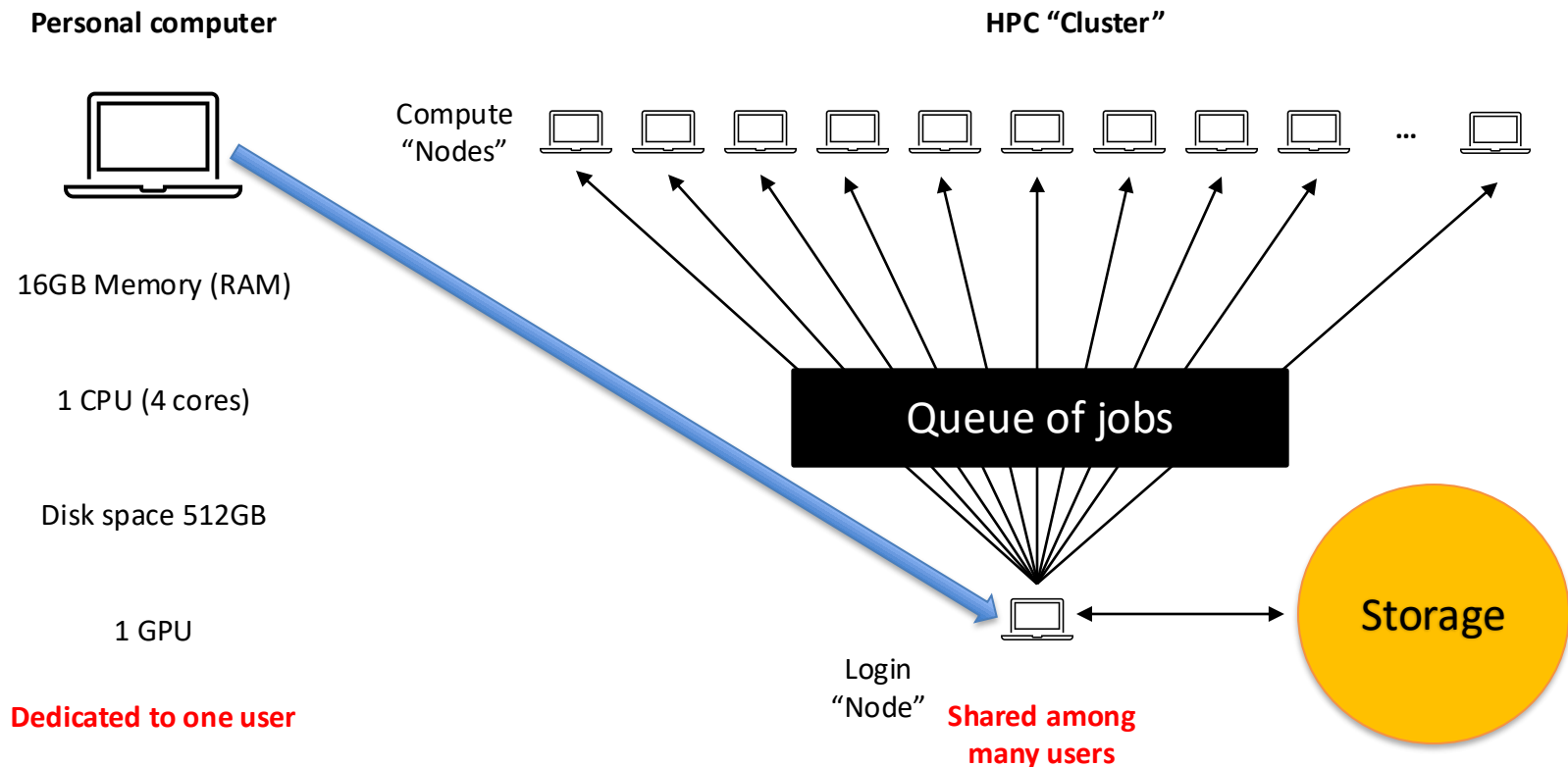
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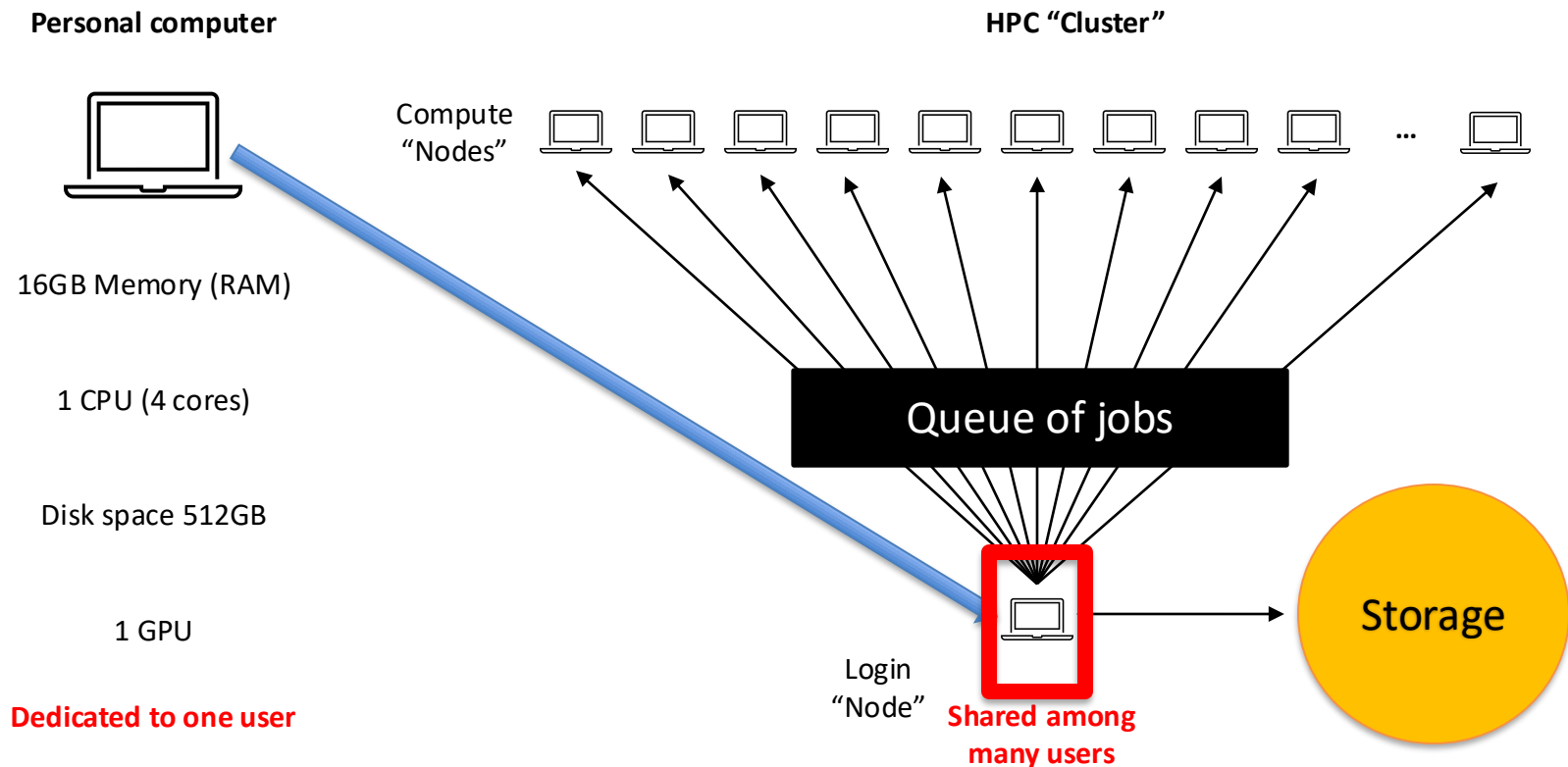
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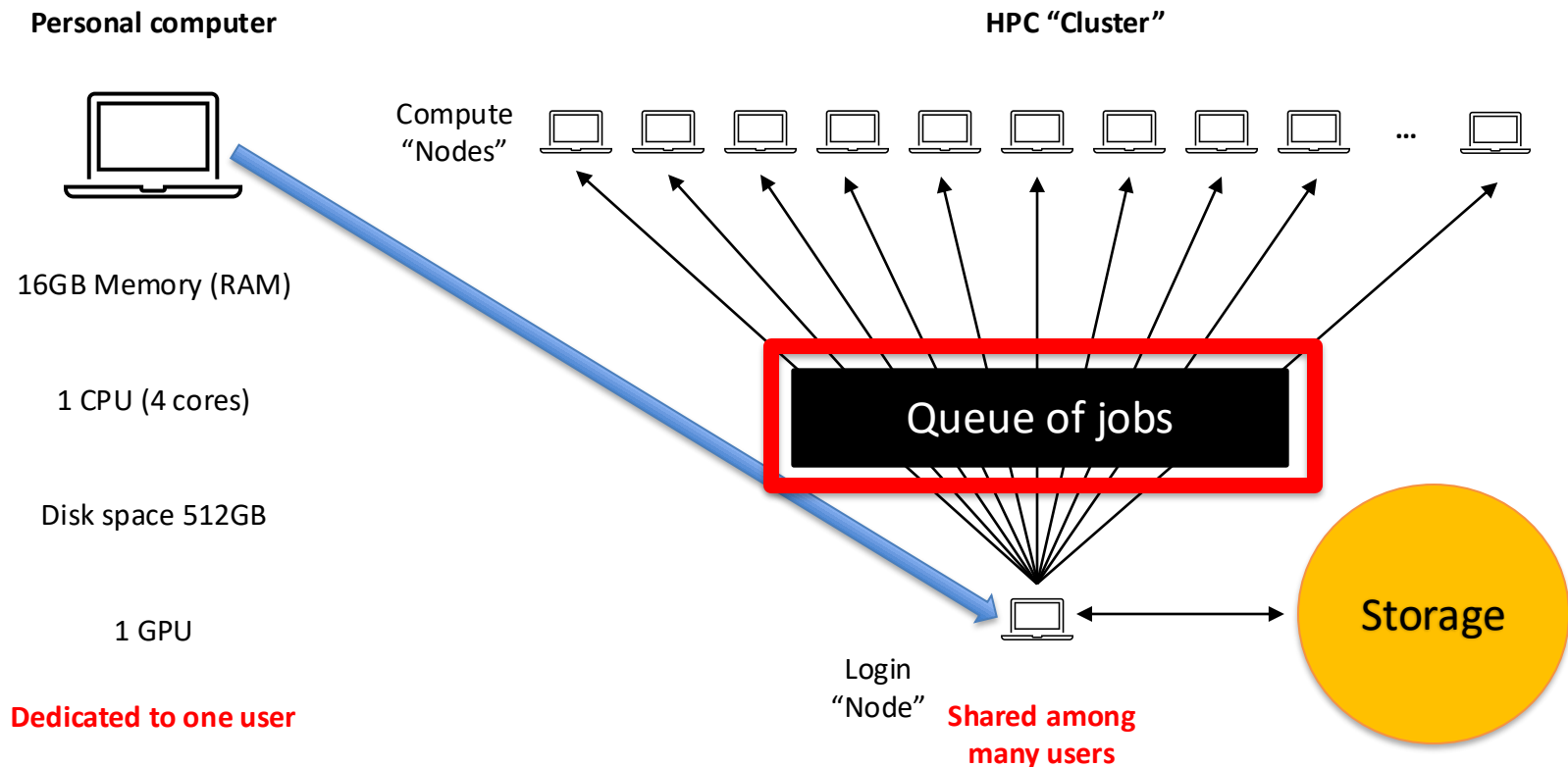
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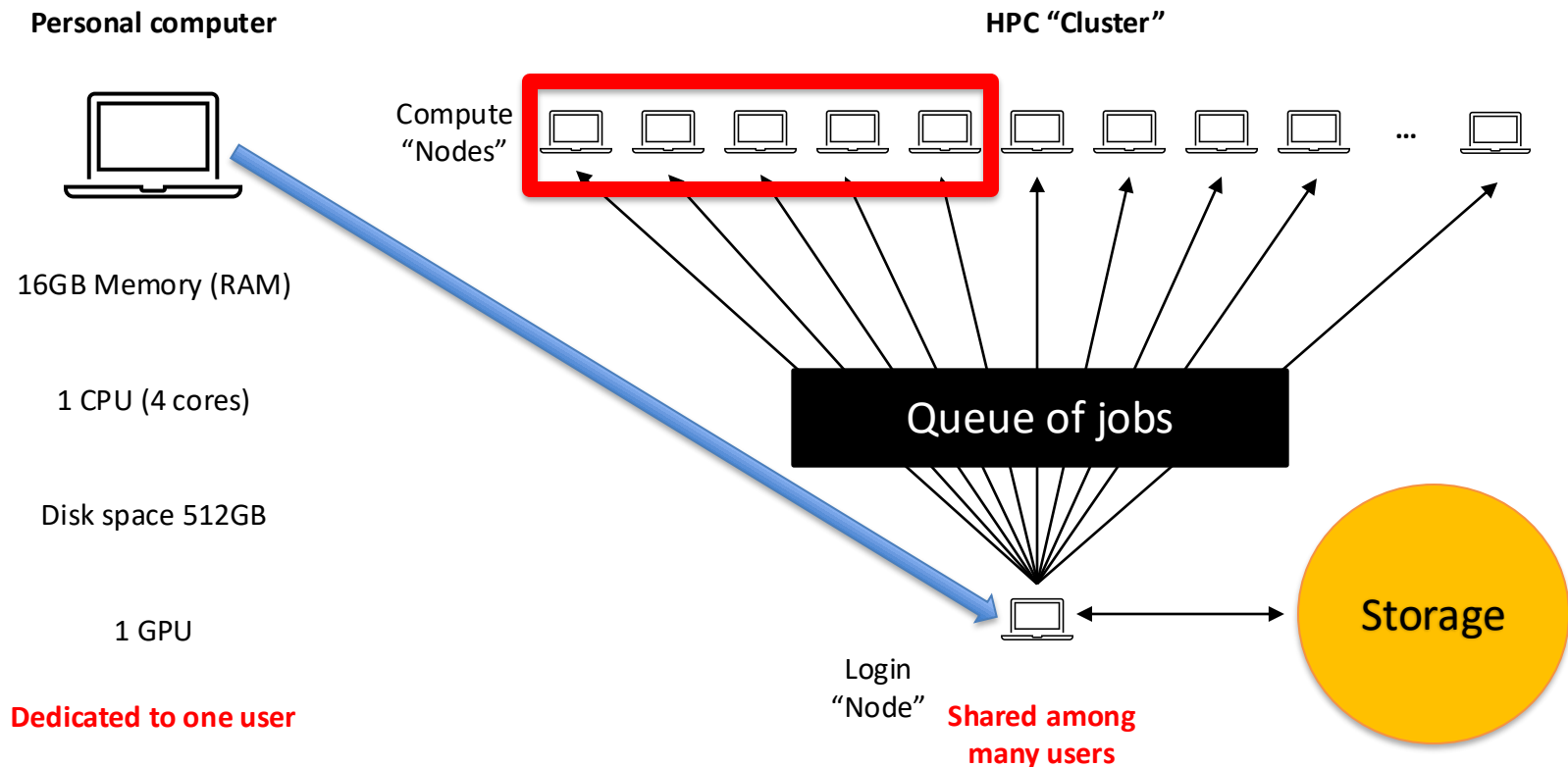
Overview of high-performance computing (HPC)



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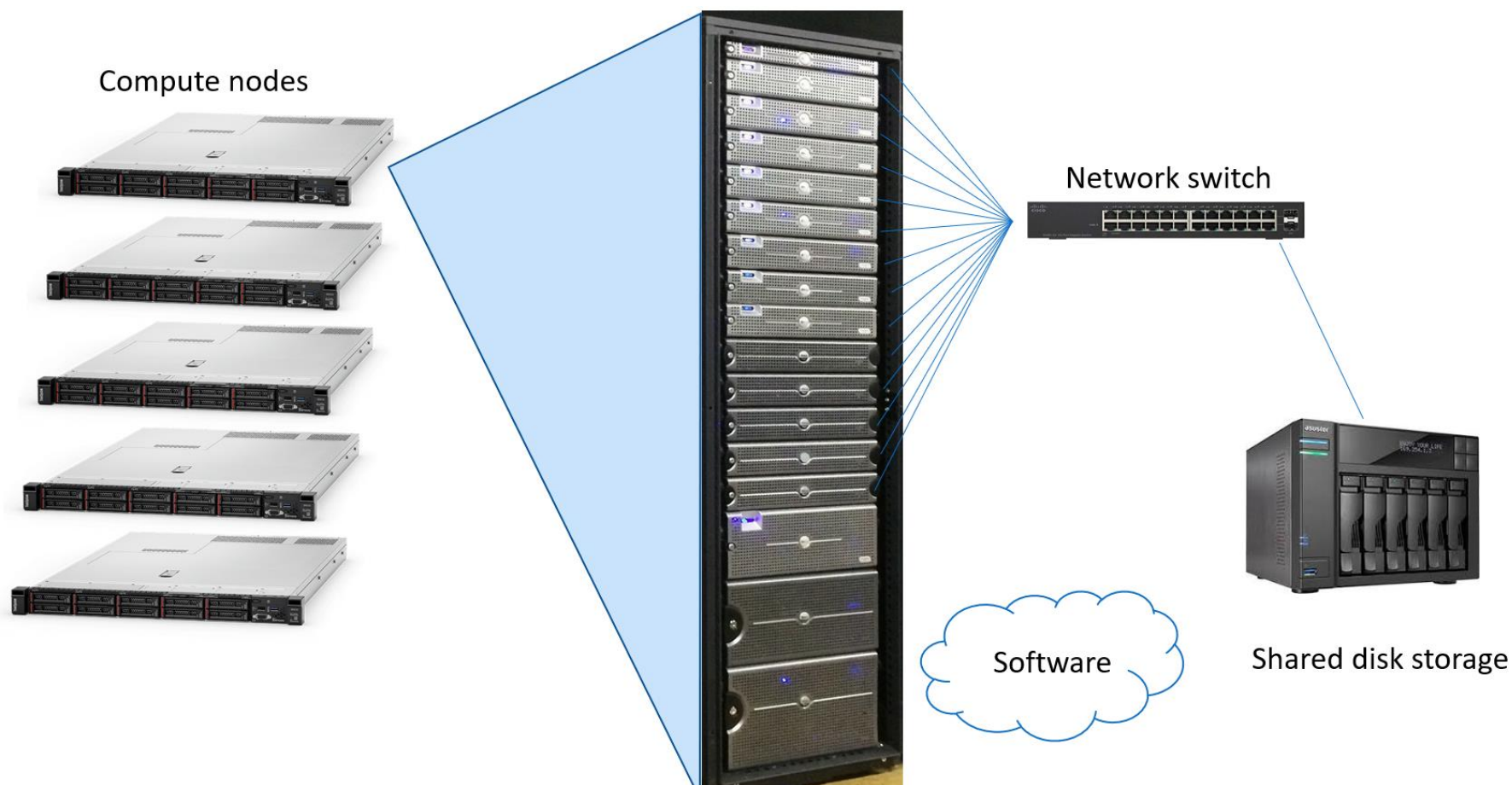
- Tens of Thousands of jobs
- Thousands of users
- 1000+ biomedical applications
- 2911 nodes, 93292 cores, 1040 GPUs
- 35 Petabytes of storage

NIH HPC Systems (Main Campus)

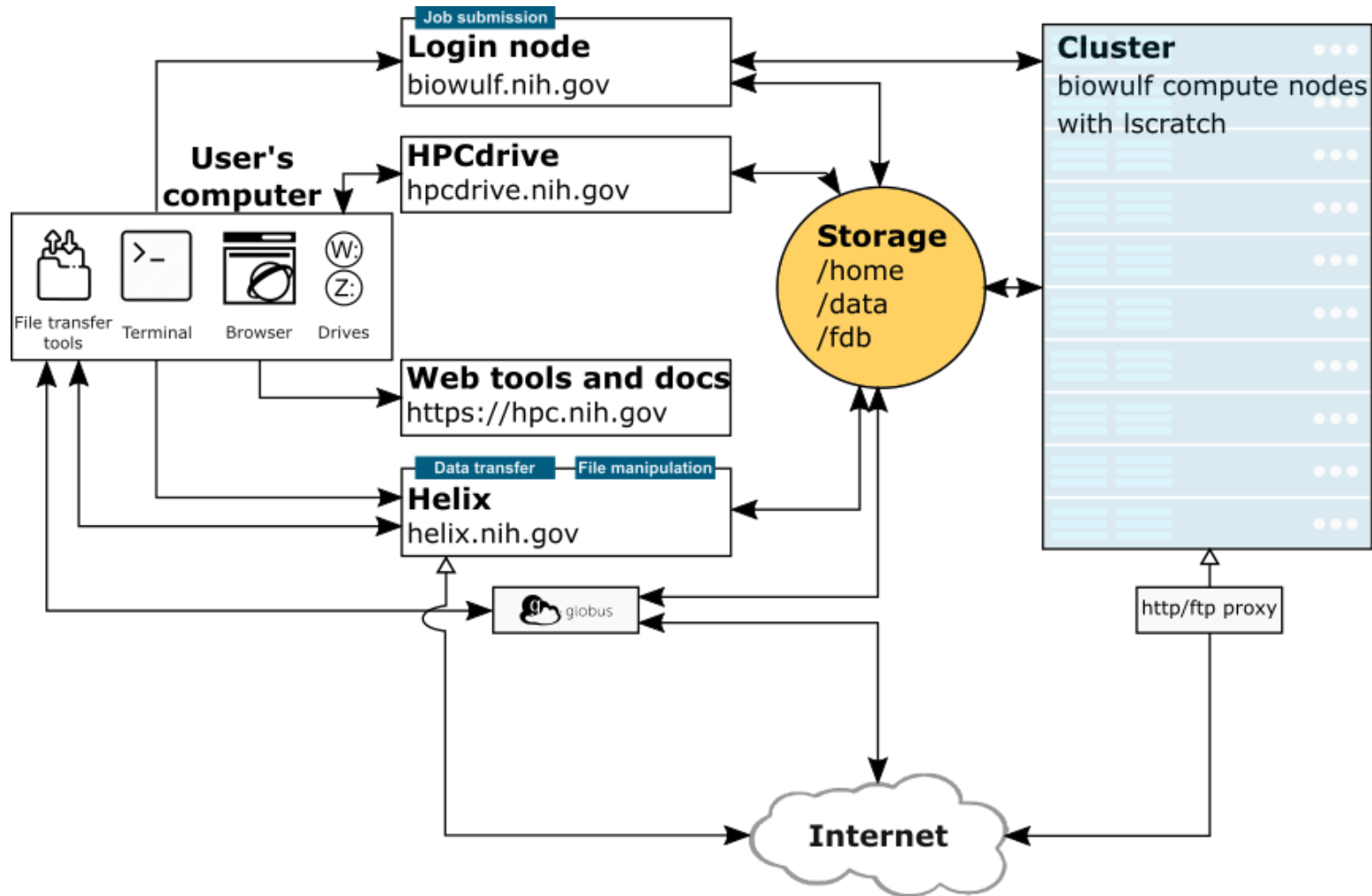


Source: <https://www.hpcwire.com/2021/08/05/prepare-to-pivot-hpc-faster-before-the-next-crisis/>

NIH HPC Systems (Main Campus)

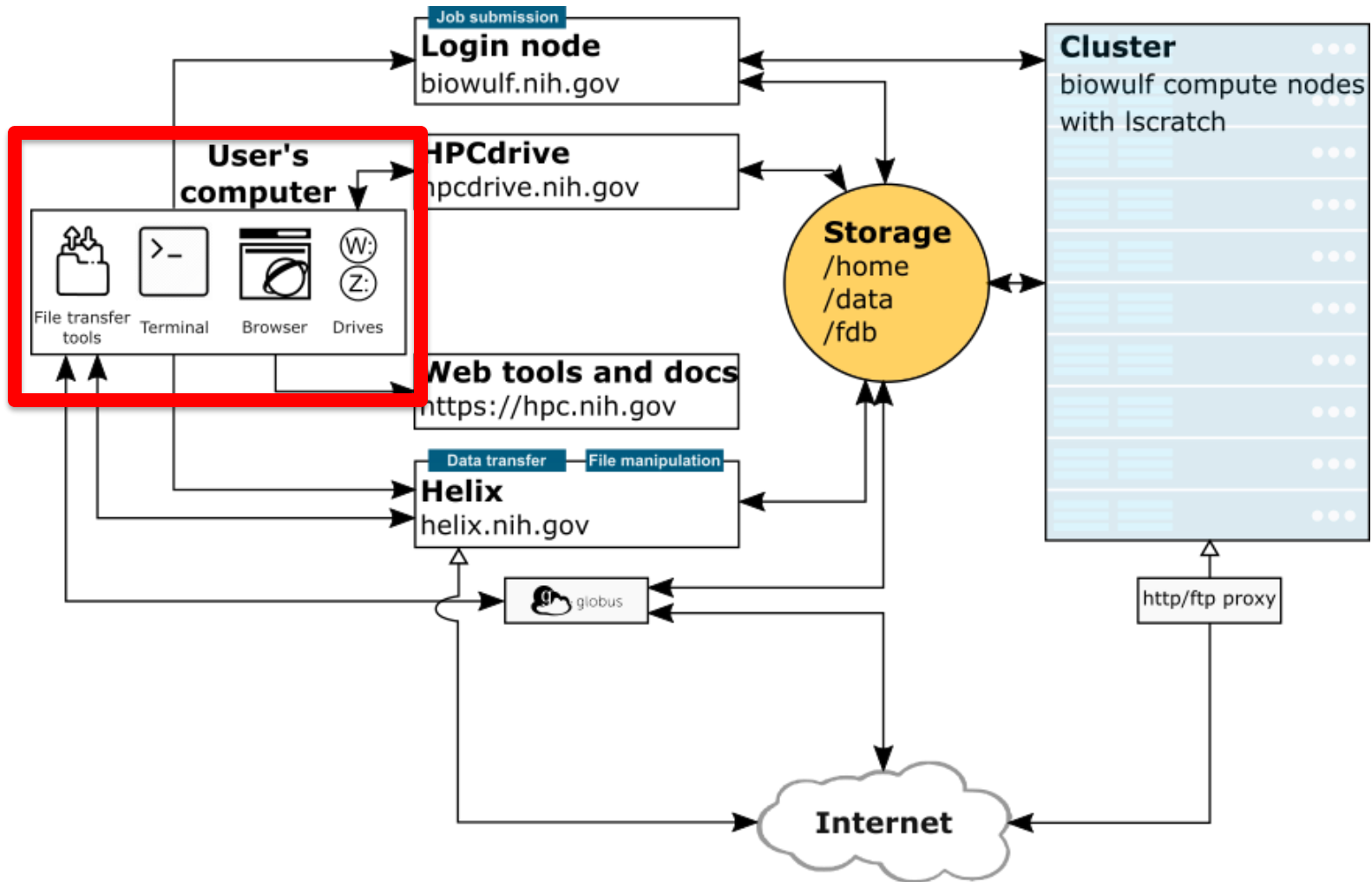


NIH HPC Systems



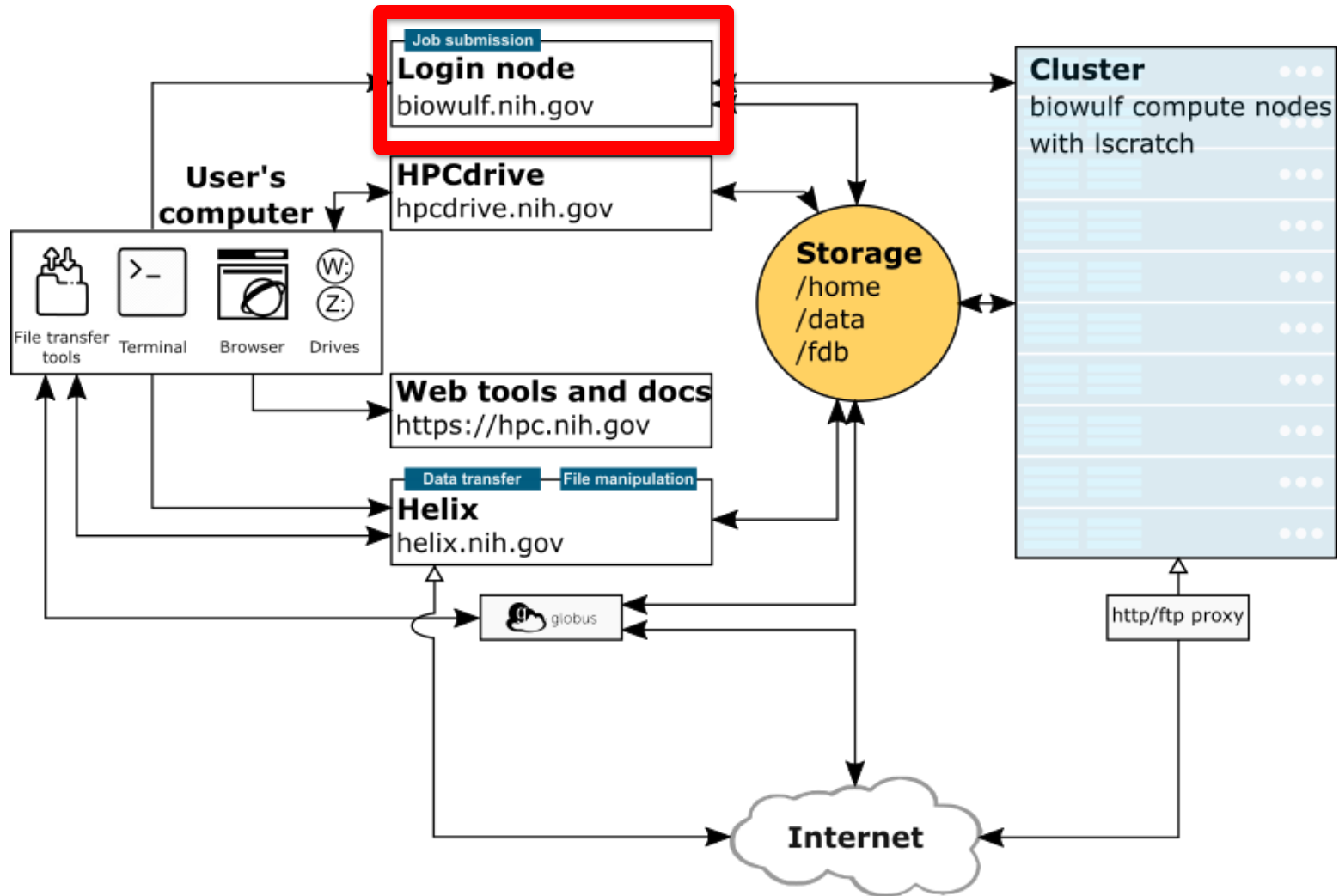
Source: NIH HPC website

NIH HPC Systems



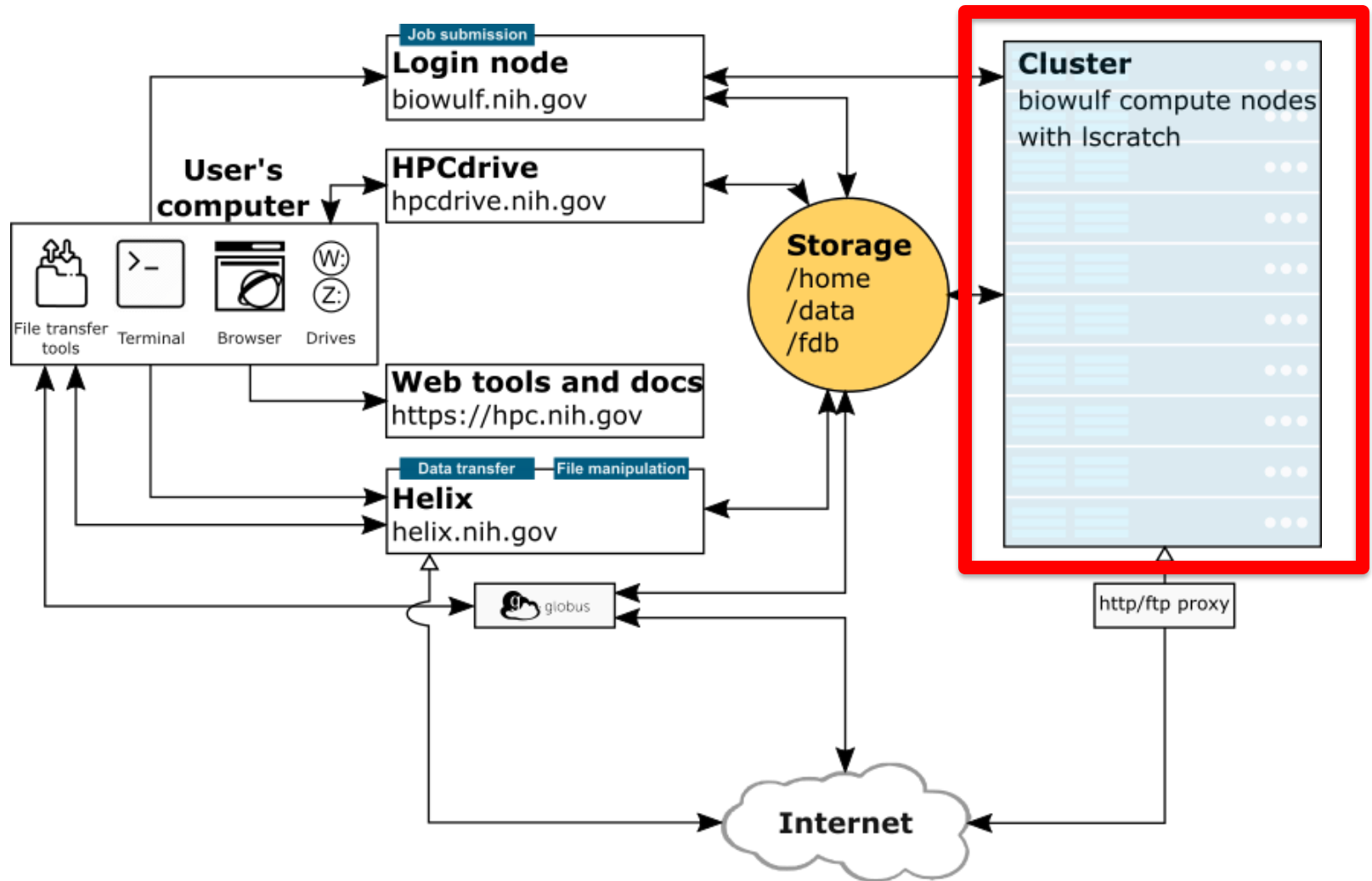
Source: NIH HPC website

NIH HPC Systems



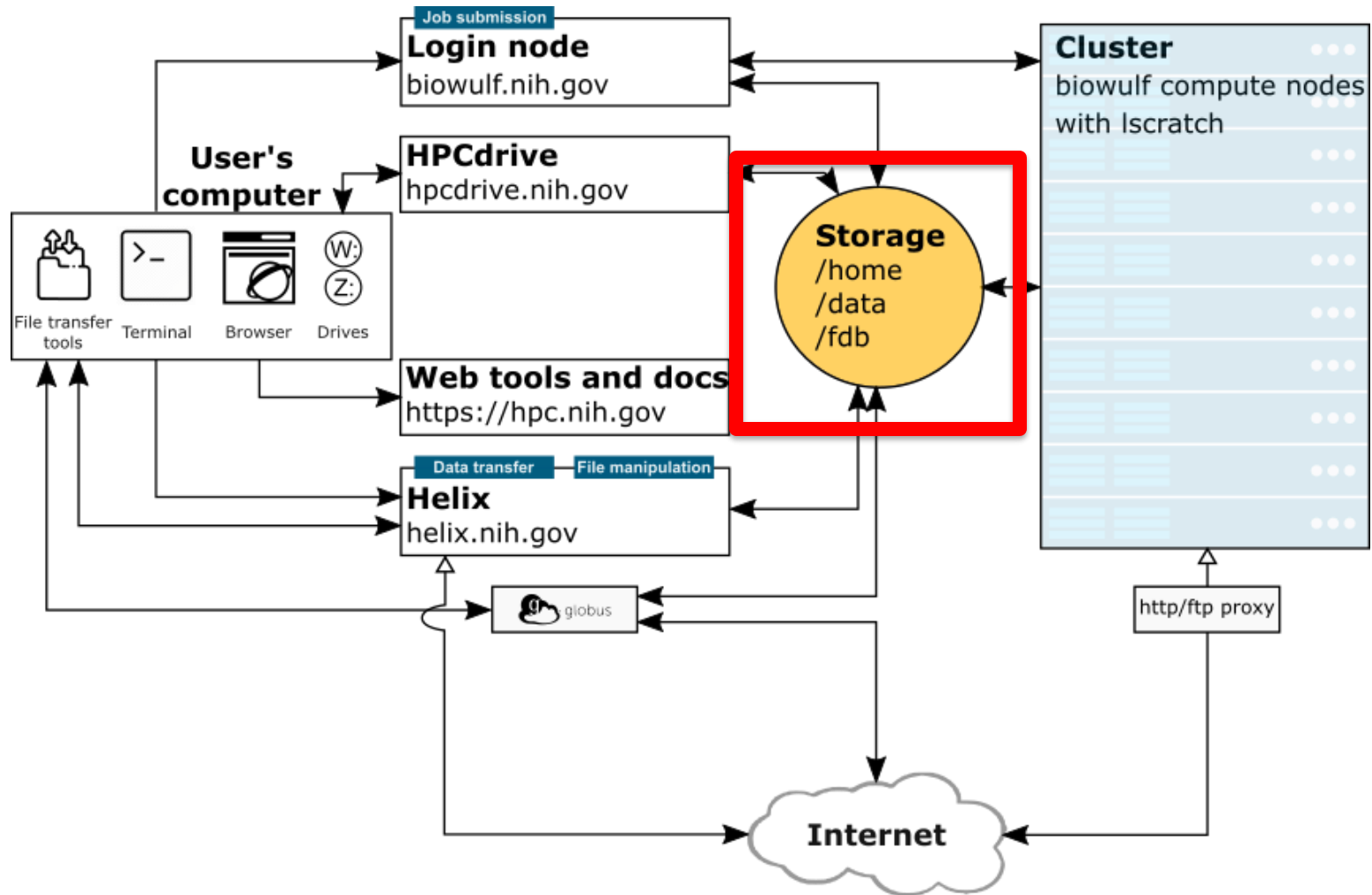
Source: NIH HPC website

NIH HPC Systems



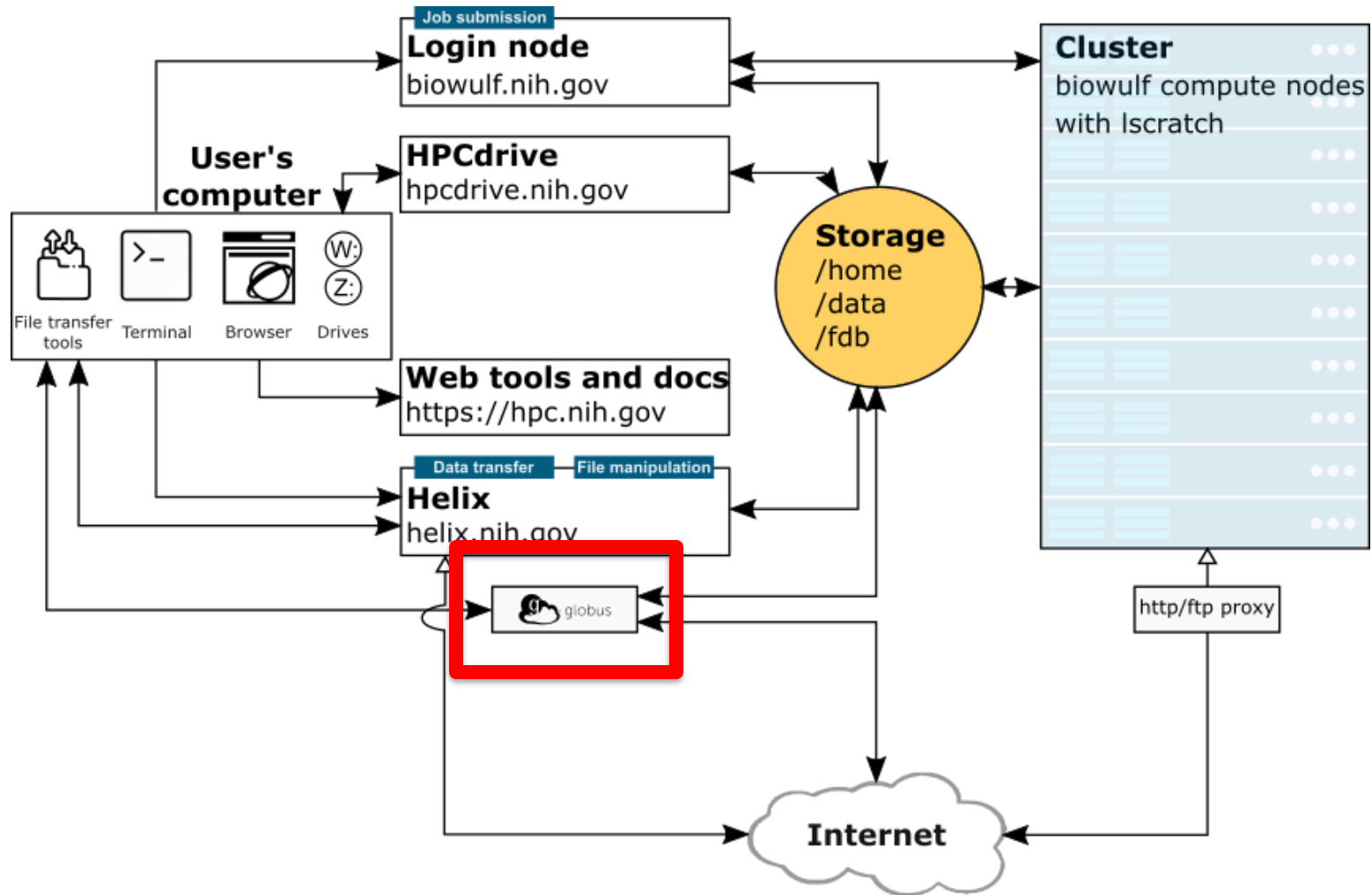
Source: NIH HPC website

NIH HPC Systems



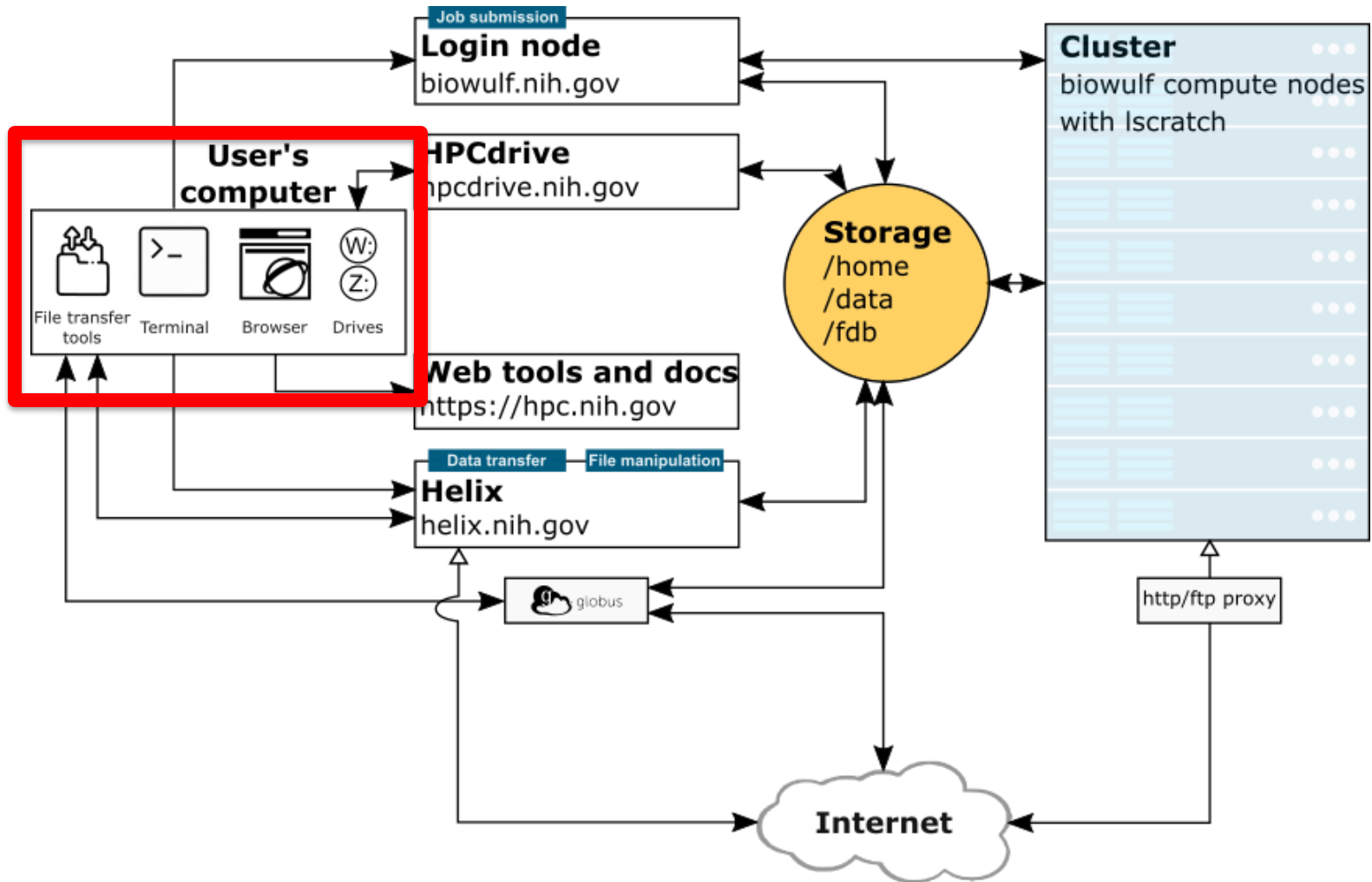
Source: NIH HPC website

NIH HPC Systems



Source: NIH HPC website

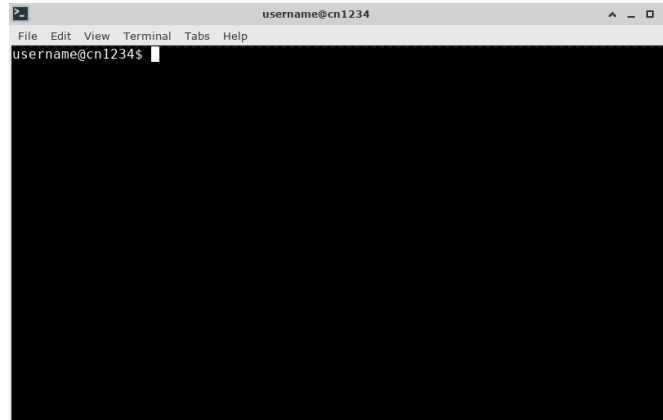
NIH HPC Systems



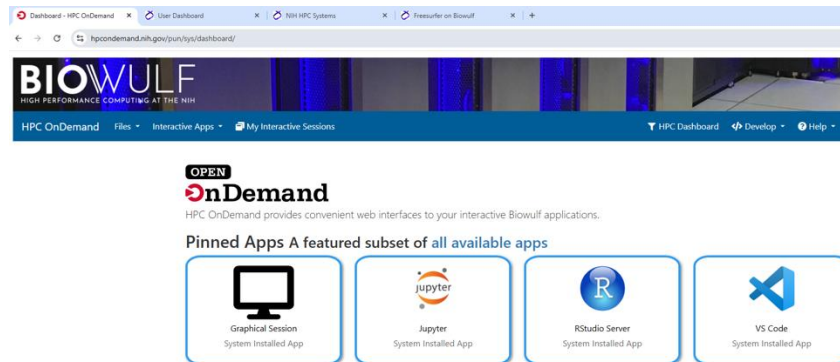
Source: NIH HPC website

Accessing Biowulf

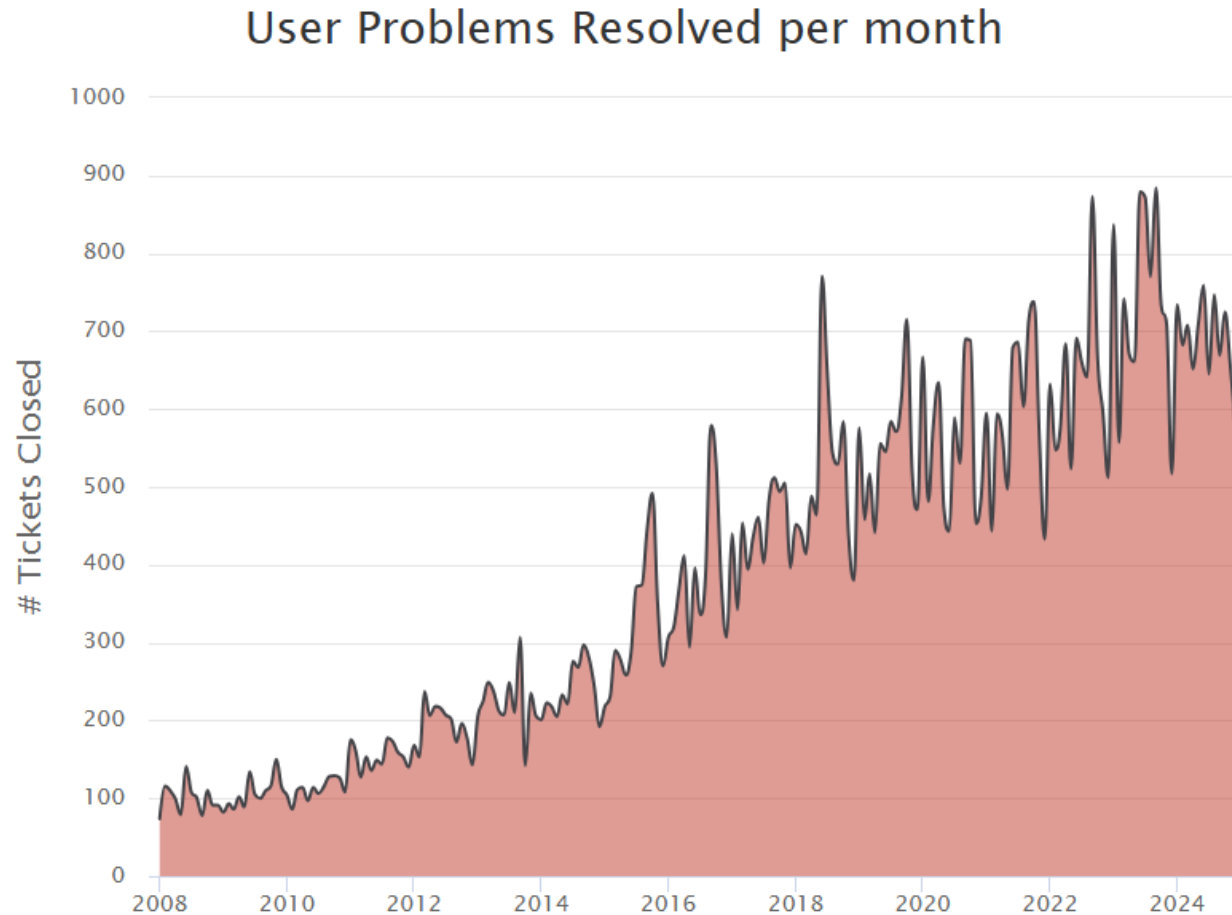
ssh (PuTTY, Powershell, Mac Terminal, ...)



HPC Ondemand

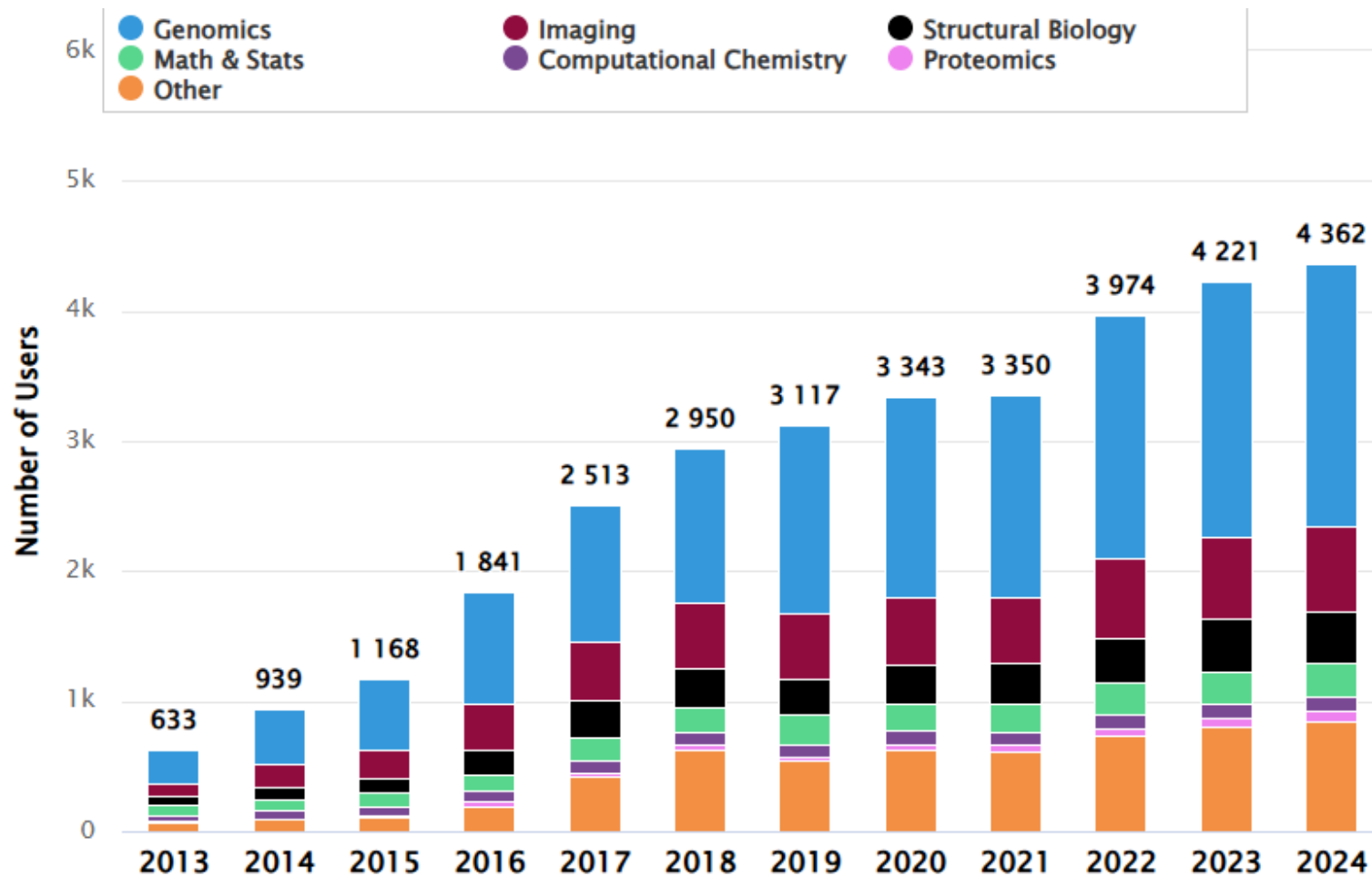


Scientific/technical support



Source: NIH HPC website

Research areas of users



Source: NIH HPC website

Sample of applications on Biowulf



WOLFRAM **MATHEMATICA**
The world's definitive system for modern technical computing



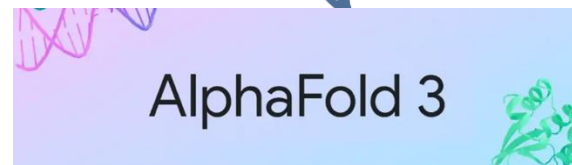
RELION

FAST. FLEXIBLE. FREE.

GROMACS



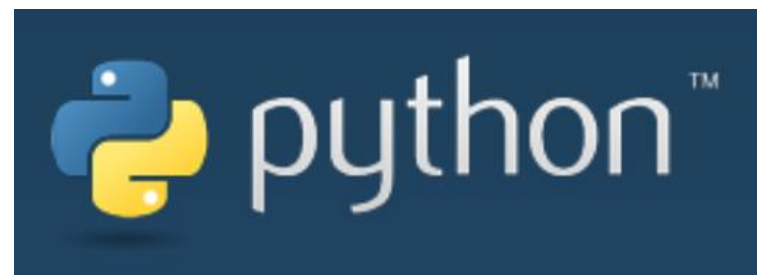
MATLAB
Programming language



NAMD
Scalable Molecular Dynamics

Samtools

VCFTools



bioBakery Workflows



Seminar Series

2025 Biowulf Seminar Series

	Nadya I. Tarasova, PhD Head Synthetic Biologics Facility Center for Cancer Research National Cancer Institute	Game-changers in computational drug discovery April 9 2025, 11am - noon Building 35A Room 640 [Videocast]
	Jiayi Chen, PhD Research Fellow Cell Biology and Biophysics Section National Institute of Neurological Disorders and Stroke	Reading and Editing the Tubulin Code June 9 2025, 11am - noon Building 35A Room 610 [Videocast]
	Paul Taylor, PhD Director Scientific and Statistical Computing Core (AFNI Group) National Institute of Mental Health	Examples of combining visualization and computation in brain imaging September 17 2025, 11am - noon Building 35A Room 610 Videocast TBA
	Alex Sodt, PhD Senior Investigator Section on Membrane Chemical Physics National Institute of Child Health and Human Development	Title TBA November 4 2025, 11am - noon Building 35A Room 640 Videocast TBA

Source: NIH HPC website

Outreach

Welcome to the **BIO**WULF walk-in consult

You are in the **lobby/triage room** for a **consult**. There is **no presentation**.

Once you let the **host** know what **topic** you would like to discuss, we will assign you to a **breakout room** for a **1:1 consult** with a staff

If you get **disconnected** please reconnect and we will place you back in your breakout room.

Please

- remember to mute
- share your screen only in a breakout room when invited
- be courteous and wait your turn if staff are already helping other users

Source: Internal NIH HPC website

NIH HPC Staff



Steve Bailey



Tim Miller



David Hoover, Ph.D.



Helen Ashdown



Simon Carlson-Thies



Gennady Denisov, Ph.D.

Picture
unavailable

Afif Elghraoui



Ali Erfani



Andrew Fant, Ph.D.



Beide (Peter) Fu, Ph.D.



Jonathan Goodson, Ph.D.



Patsy Jones

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unavailable

Charles Lehr



Jean Mao, Ph.D.



Nitish Narula

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David O'Brien

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Ifeanyi Okoye



Antonio Ulloa, Ph.D.



Renbin Yang, Ph.D.



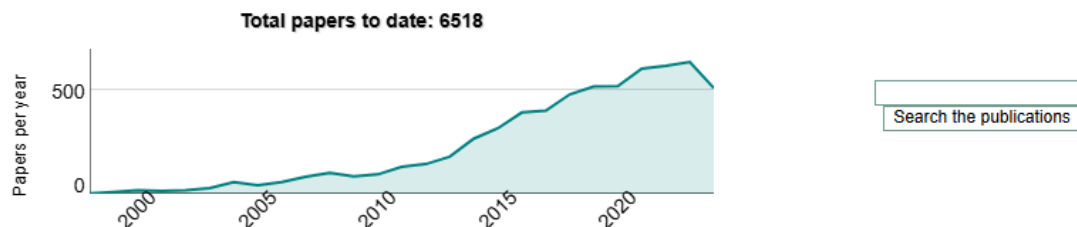
Qi Yu, Ph.D.

Source: NIH HPC website

NIH HPC Acknowledgements

Papers that used NIH HPC (Biowulf) resources

If you have published research that has made significant use of these systems, please let us know by sending email to staff@hpc.nih.gov



2025 to date (177 papers)

- [Y665F variant of mouse Stat5b protects against acute kidney injury through transcriptomic shifts in renal gene expression](#) Jankowski, J; Lee, HK; Hennighausen, L; , *Sci Rep*, DOI://10.1038/s41598-025-15812-0 (2025)
- [Ocular immune privilege in action: The living eye imposes unique regulatory and anergic gene signatures on uveitogenic T cells](#) Peng, Z; Nagarajan, V; Horai, R et al. *Cell Rep*, DOI://10.1016/j.celrep.2025.115780 (2025)
- [Multiplexed Nanoscale Viscoelastic Mapping at Multiple Time Scales of Melanoma Cells as a Label-Free Cancer Biomarker](#) Parvini, C; Massey, A; Mezher, M; Cartagena-Rivera, AX; , *ACS Nano*, DOI://10.1021/acsnano.5c01873 (2025)
- [Structural insights into SSNA1 self-assembly and its microtubule binding for centriole maintenance](#) Agostini, L; Pfister, JA; Basnet, N et al. *Nat Commun*, DOI://10.1038/s41467-025-62696-9 (2025)
- [Biobank-scale genetic characterization of Alzheimer's disease and related dementias across diverse ancestries](#) Khani, M; Akçimen, F; Grant, SM et al. *Nat Commun*, DOI://10.1038/s41467-025-62108-y (2025)
- [Genetic background and oncogenic driver determines the genomic evolution and transcriptomics of mammary tumor metastasis](#) Ross, CR; Szczepanek, K; Sanford, J et al. *Commun Biol*, DOI://10.1038/s42003-025-08624-5 (2025)
- [A highly conserved sRNA downregulates multiple genes, including a σ54 transcriptional activator, in the virulence mode of Bordetella pertussis](#) Sim, M; Nguyen, J; Škopová, K et al. *mBio*, DOI://10.1128/mbio.01356-25 (2025)
- [An open-source nanopore-only sequencing workflow for analysis of clonal outbreaks delivers short-read level accuracy](#) Vereecke, N; Yoon, TB; Luo, TL et al. *J Clin Microbiol*, DOI://10.1128/jcm.00664-25 (2025)
- [Resolution of Squamous-Cell Carcinoma by Restoring T-Cell Receptor Signaling](#) Ye, P; Bergerson, JRE; Brownell, I et al. *N Engl J Med*, DOI://10.1056/NEJMoa2502114 (2025)
- [Prospective associations of breastfeeding parents' postpartum dietary intake with infant gut microbiome at 6 months in the Pregnancy Eating Attributes Study](#) Sanjeevi, N; Dreisbach, C; Peddada, S et al. *J Acad Nutr Diet*, DOI://10.1016/j.jand.2025.07.005 (2025)
- [The Kinase Inhibitor GNF-7 Is Synthetically Lethal in Topoisomerase 1-Deficient Ewing Sarcoma](#) Sayers, CM; Carter, MB; Lei, H et al. *Cancers (Basel)*, DOI://10.3390/cancers17152475 (2025)
- [Identification of GGC Repeat Expansions in ZFX3 among Chilean Movement Disorder Patients](#) Saffie-Awad, P; Moller, A; Daida, K et al. *Mov Disord*, DOI://10.1002/mds.30242 (2025)
- [SCassist: an AI based workflow assistant for single-cell analysis](#) Nagarajan, V; Shi, G; Arunkumar, S et al. *Bioinformatics*, DOI://10.1093/bioinformatics/btaf402 (2025)

Source: NIH HPC website

Questions? Comments?

staff@hpc.nih.gov