GLOBUS OVERVIEW

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Globus Overview

Outline

What to Expect From This Talk

Objectives

- What is Globus – history, capabilities, strengths
- What Globus is not
- Globus terminology and concepts
- Use cases – data transfers and sharing
- Pitfalls
- Demo

Globus Overview

Storage and Data Management

Storage and Data Management

There is more to Research Computing than just computing!

- We are best known for our supercomputing clusters – but if it wasn't for storage and other cyberinfrastructure, where would you put all those nice things you've just calculated?
- See www.rcac.purdue.edu/storage for all our storage options
- An interactive storage solutions finder: www.rcac.purdue.edu/storage/solutions/
- Also check out www.rcac.purdue.edu/services for other services we provide

Storage and Data Management

There is more to Research Storage than just storage!

Locations

- Home directory
- Cluster scratch

- Data Depot
- Fortress

- Lab instrument
- Office workstation
- Laptop

- Cloud services
- PURR

Actions

- Generate
- Process/analyze
- **Transfer**
- **Share**
- **Publish**

globus

Globus Overview

Globus

What is Globus?

Non-profit service for secure, reliable research data management

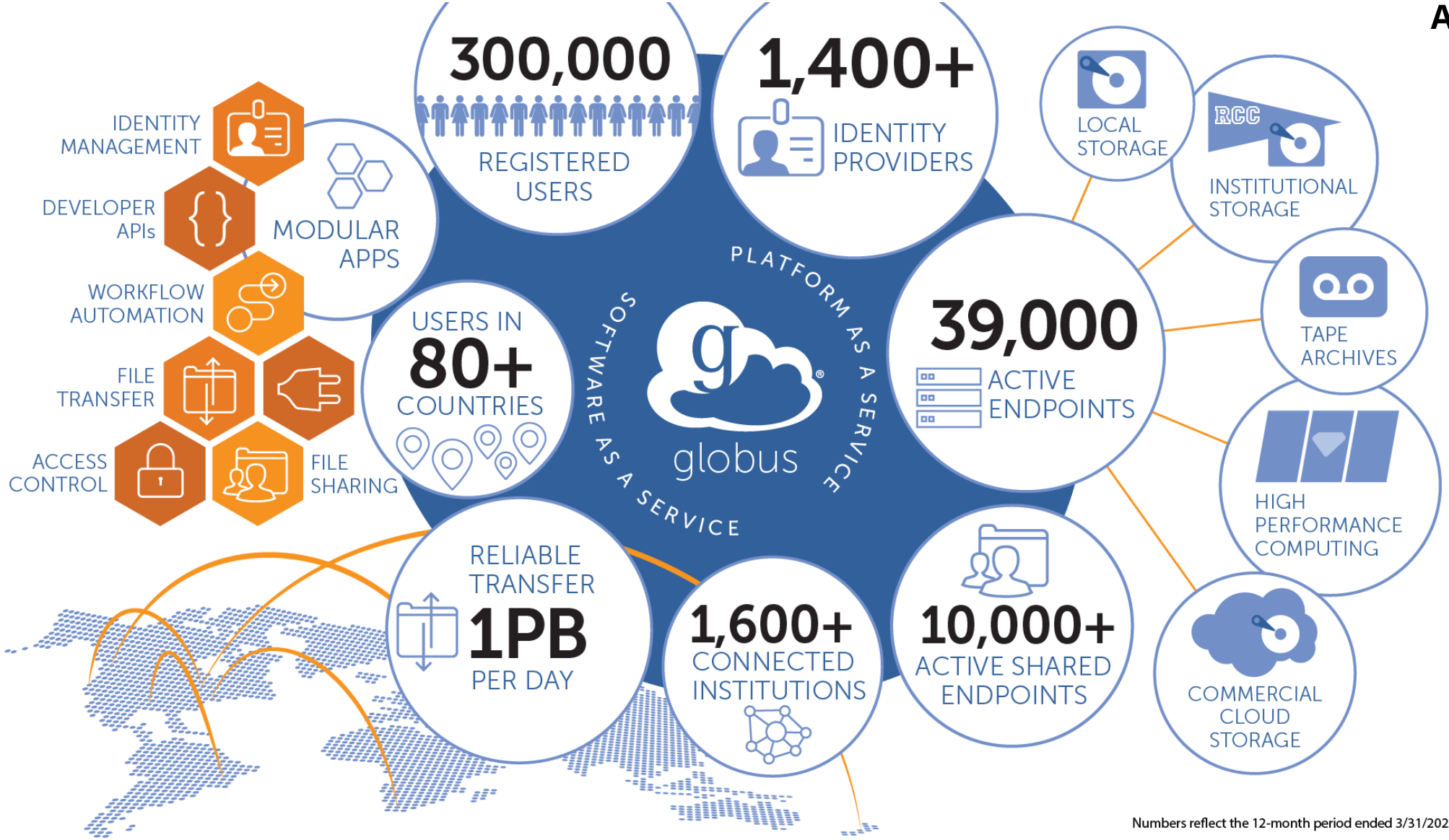
- A platform and a service for moving, sharing and discovering data via a single interface
- A team at the University of Chicago and Argonne National Laboratory
- Funded by NSF, DoE, NIH and institutional subscriptions (freemium model)
  - Purdue is subscribed, RCAC pays

What is Globus?

History

- Stems from GridFTP and high energy physics community
- Started as a pure transfer tool with two strengths:
  - **Fast transfers over good networks**
  - **Robust transfers over flaky networks**
- Added functionality:
  - **Data sharing and flexible access control**
  - Identity management
  - Web GUI, scriptable command line tool, and powerful API with a Python SDK
  - Cross-platform
  - Great support

As of April 2022



Numbers reflect the 12-month period ended 3/31/2022

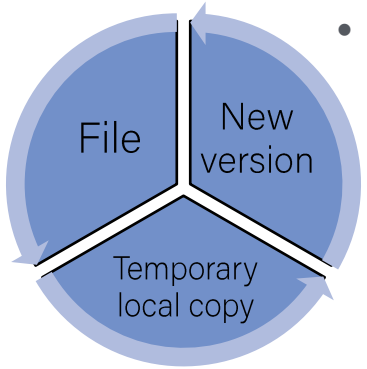
https://www.globus.org/what-we-do

What Globus is NOT?

Globus is not your typical network drive!

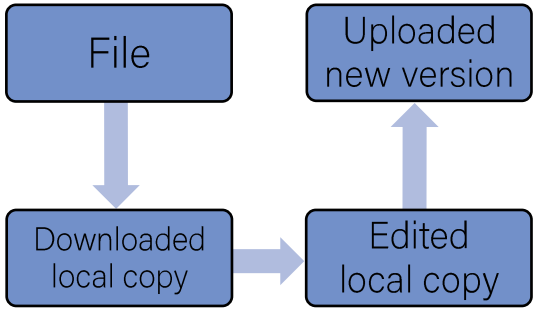
What happens when you double-click on a Word document on a network drive?

- A copy of the document is transparently downloaded by the system
- You edit local temporary copy in Word
- A saved version is transparently uploaded back to the network drive at the end



What happens when you ~~double-~~click on a Word document in Globus?

- **Nothing. It's a transfer tool!**
- The *"download"*, *"edit"*, *"upload"* steps are fully decoupled and have to be done <u>explicitly</u> by you



- On some modern endpoints, you may be taken to the browser's *"Open/download"* dialog, but still no automatic back and forth
- Negishi and Anvil have this feature, more to come

Globus Data Transfers

Globus transfers overview

- Secure unified interface to your data
- *"Fire and forget"* (Globus monitors the transfer, auto-resumes on errors, sends an email at the end)

- **Note: *the data channel is directly between A and B***

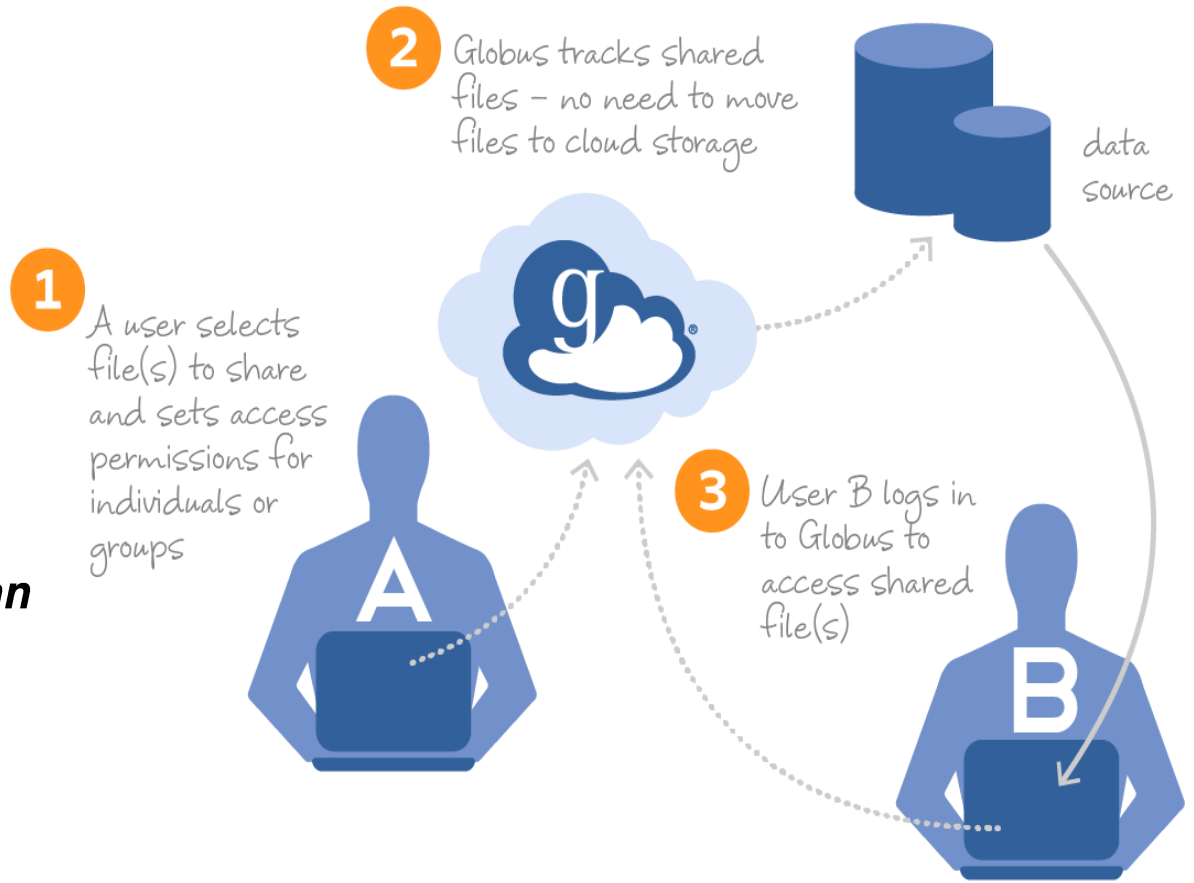
- Your computer is only used for the command channel (dispatch a terabyte transfer using your phone!)
  - **If the transfer is not from your computer, your computer does not have to stay on**

https://www.globus.org/data-transfer

Globus Data Sharing

Globus sharing overview

- Easy (all you need is recipient's email)
- Secure
- Flexible access control (user(s), groups, world, read, write)
  - Premium feature – subscription benefit
- No more *"Hey, I uploaded ~~a terabyte~~ to Google Drive, what's you Gmail?"*
- **Note: *User B does not need to have an account on your storage system!***
- Approved for HIPAA data, too.
  - Purdue does not have a HIPAA-compliant endpoint yet, but we will!



https://www.globus.org/data-sharing

Globus Vocabulary

Vocabulary: Collections, Shares and Endpoints

"A named location containing data you can access with Globus"

Historic terminology:

- **"Endpoints"** (or "primary endpoints") – the main location itself (e.g. *"Purdue Data Depot"*).
- **"Shares"** (or "shared endpoints") – parts of the primary endpoint that have been given their own names and shared via Globus (e.g. *"My subfolder for User B"*).
  - "A share off of a primary endpoint"

User adoption is slow, people often still use "Endpoints" in the sense of "Collections"

Globus recently adopted new terminology:

- **"Endpoint"** refers to hardware/software/ system component (what admins deal with)
- **"Collections"** refers to the named location components (what users deal with)
  - **"Mapped collections"** – where a Globus identity is mapped to a local user *(== old "primary endpoints")*
  - **"Guest collections"** – parts of the mapped collection that have been given their own names and shared via Globus *(== old "shares")*

Globus Vocabulary

Vocabulary: Globus Account and Identities

"You and the hats you wear"

- Globus needs a handle to know you by (and to authenticate you) – a Globus account
- In the simplest form, this is your organizational login, but there are many more *Identity Providers* that Globus recognizes (e.g. Gmail, ORCiD, ACCESS ID, etc).
  - Purdue is recognized – *"Purdue University Main Campus"*
- When you first login to Globus, your Globus account will be established. You will be asked to chose your Organization (a.k.a. Identity Provider).
  - If it is one of the 1400+ Globus recognizes, it'll send you to the organizational login page (like BoilerKey)
  - Otherwise, Globus can serve as its own identity provider (the Globus ID)

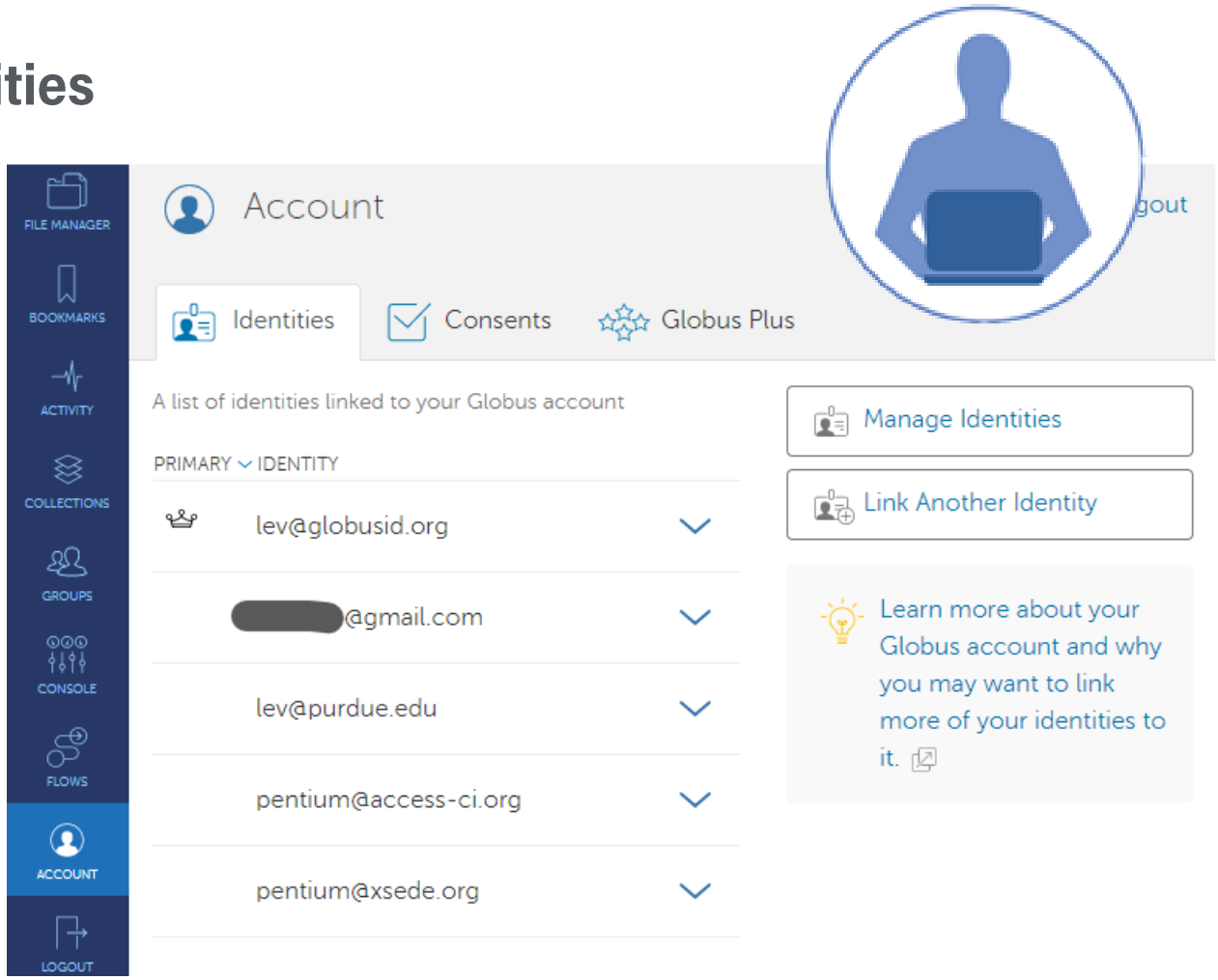
*Note: **anyone** can use Globus! You do **not** have to be in one of the recognized organizations!*

Globus Vocabulary

Vocabulary: Globus Account and Identities

"You and the hats you wear"

- You have a Purdue career account, a Gmail, another university account, an ORCiD, an ACCESS account, etc, – but this is still the same you
- *A Globus account is a set of linked identities that you have used to login to Globus*
  - You don't have to link them, but it is handy
  - https://app.globus.org/account/ or https://transfer.rcac.purdue.edu/account/



Globus Overview

Globus Login and Demo

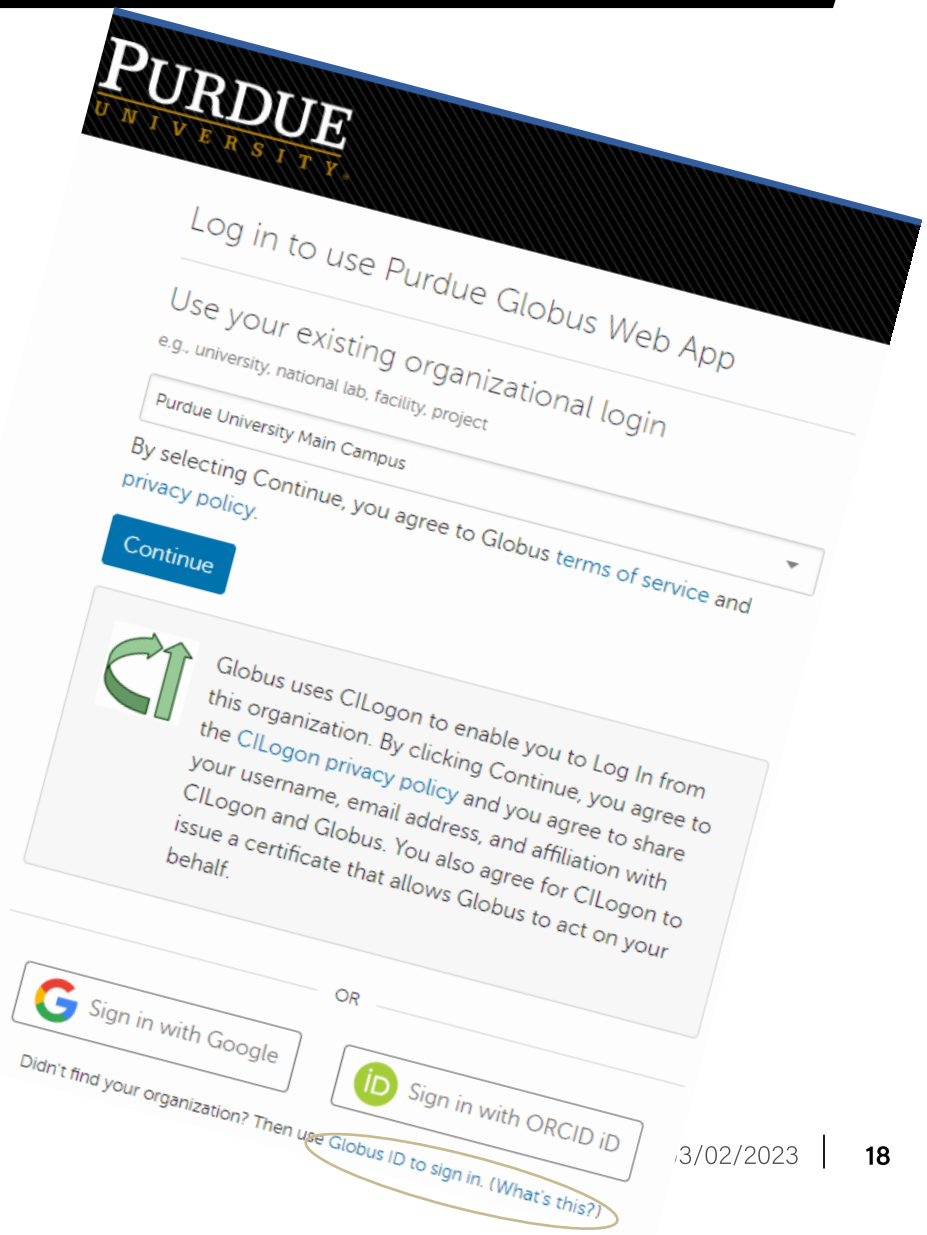
Login to Globus

transfer.rcac.purdue.edu or **globus.org**

- Purdue people: select *"Purdue University Main Campus"* as Organization. Will be taken to the BoilerKey 2FA page.

- Non-Purdue people
  - From organizations known to Globus: search for their institution in the *Organization* drop-down menu. Will be taken to their institution's login page.
  - From organizations not known to Globus: "use **Globus ID** to sign in".

- You will land in *"File Manager"* tool
- Docs: docs.globus.org/how-to/get-started/



Globus Demos

Data transfers

- Go to transfer.rcac.purdue.edu or globus.org and login using *"Purdue University Main Campus"* as organization from drop-down menu. Use BoilerKey 2FA.

- Globus transfers:
  - In the *"File Manager"* tool, search for source collection in one panel, destination collection in another panel... highlight files, tweak options, hit *"Start!"*
  - Can be scheduled (repeated on a timer!)
  - Globus getting started guide: docs.globus.org/how-to/get-started/ (also in every RCAC resource's User Guide under *"File Storage and Transfer"* section)

Globus Demos

Data Sharing

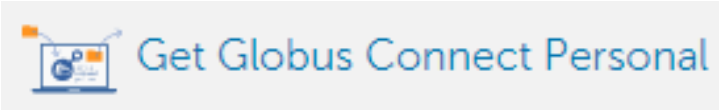
- Globus can be used for sharing – **even when recipient(s) do not have account on our system!**
- Go to transfer.rcac.purdue.edu or globus.org and login using *"Purdue University Main Campus"* as organization from drop-down menu. Use BoilerKey 2FA.
- Globus sharing:
  - *"European colleague needs to get (or put) a terabyte of data in my scratch space"*
  - In *"File Manager"*, navigate to files you want to make available, click "Share" to create a share, then select people/groups to grant access. Read-only or read-write.
  - Globus sharing guide: docs.globus.org/how-to/share-files

Globus Demos

Globus Connect Personal: make your computer an endpoint

- Not needed to transfer between *existing* endpoints
- Needed to teach your computer speak Globus

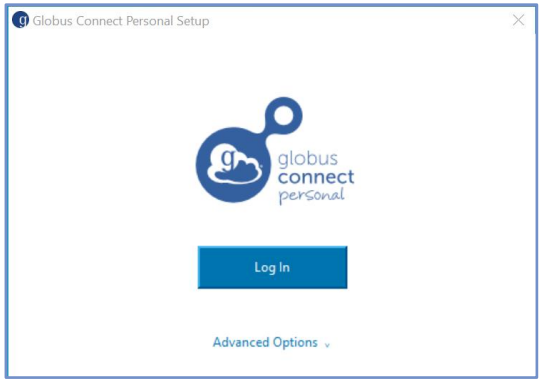
- Download: app.globus.org/file-manager/gcp
  or from the *"Collections"* section inside Globus:

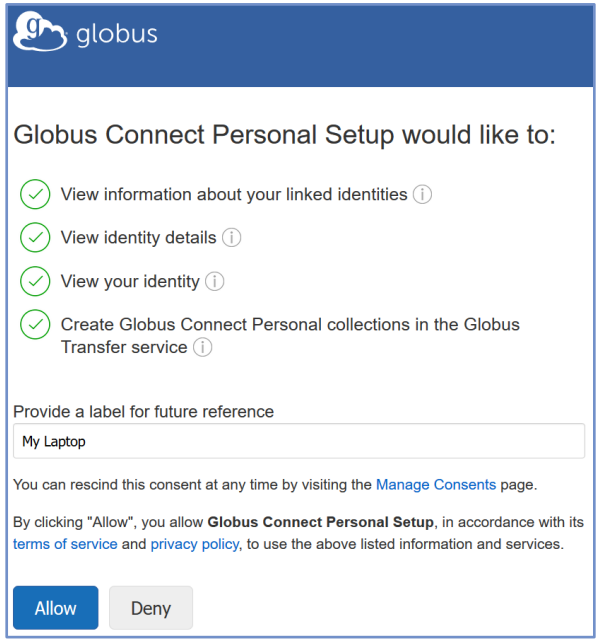


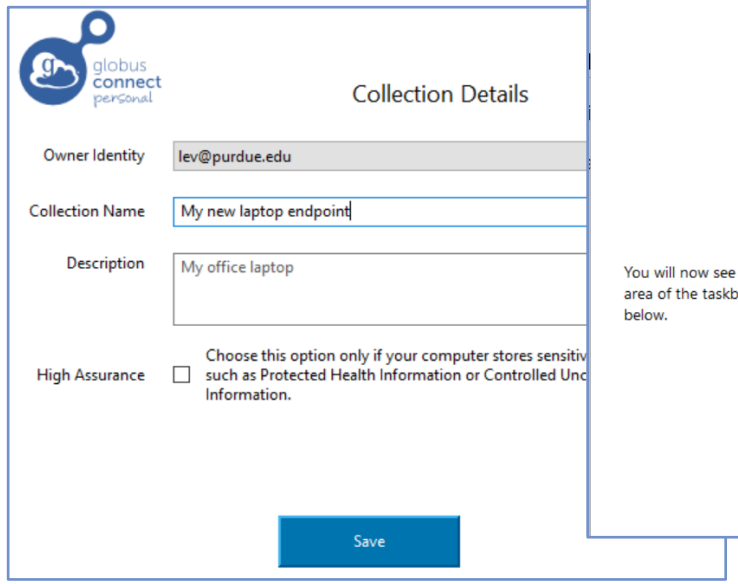
- Versions for all major OS: www.globus.org/globus-connect-personal
- Does not require administrator privileges

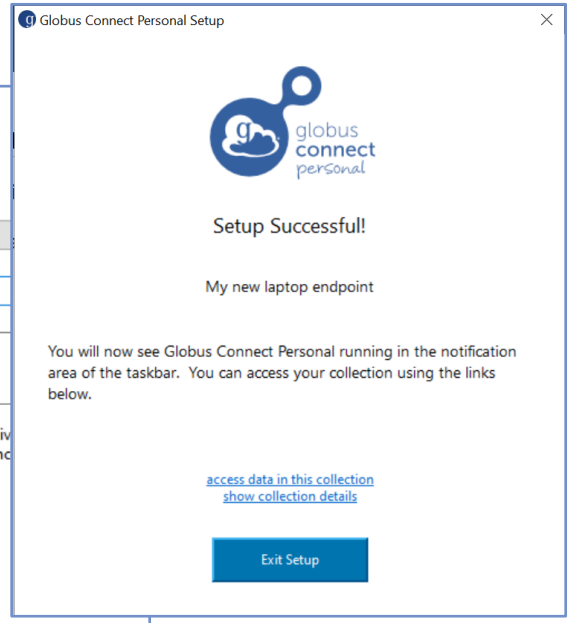
- Detailed docs:
  - For Windows
  - For Mac OS X
  - For Linux

Example installation of Globus Connect Personal

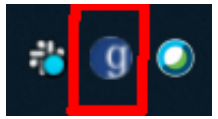








Runs in the taskbar



Globus Overview

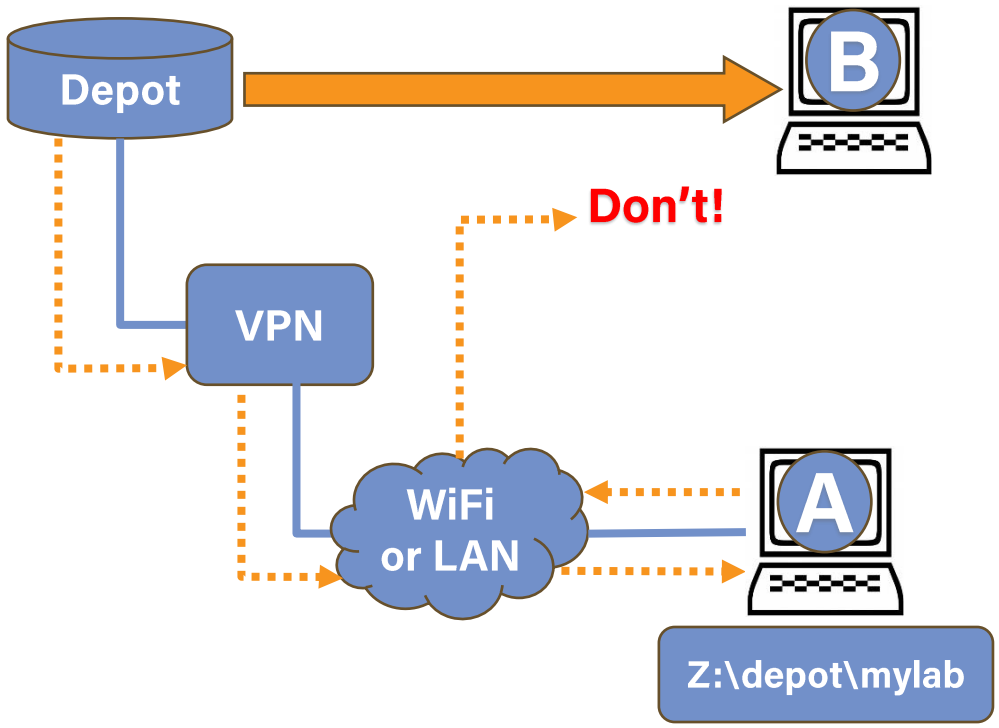
Globus Tips and Tricks

Do’s, dont’s and usage scenarios

Globus Tips and Tricks

A note on VPN and network paths

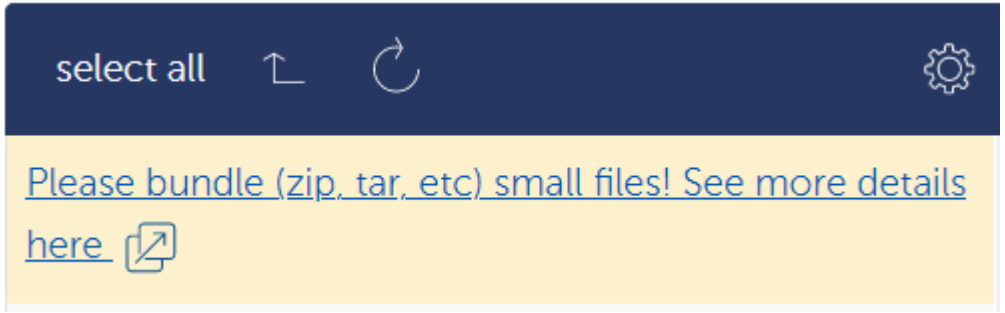
- You do *not* have to be on VPN to use Globus
- For Globus transfers to/from your computer, *VPN will slow you down*
- Common mistake
  - *"I have Data Depot mounted on my computer as a network drive, I will use Globus Connect Personal on my computer and share/transfer off of that drive"*
  - **Painfully slow and flaky** (data travels from Depot, through Purdue VPN, down to your PC, and then up from PC to the destination)
  - Share/transfer from the **main Depot collection instead** (direct flow *Depot -> destination*!)



Globus Tips and Tricks

Fortress... bundle up!

- You will see this warning on Fortress collections:

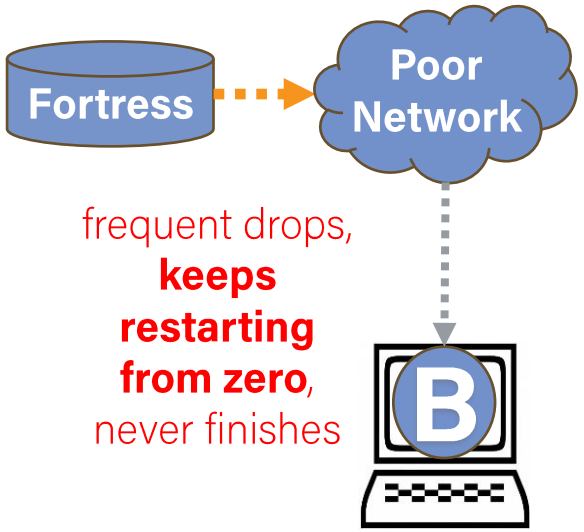


- Fortress is a tape archive
  - Give it 1 GB in one file, and it will fly through it happily
  - Give it the same 1 GB in a million of 1 KB files, and storage admins will not like you (and *you* will not like yourself when it comes to extraction)
- Globus makes it way too easy to *"just drop"* a million of small files, so please be aware (and don't)!
  - A *"small file"* on Fortress scale is something under 30-50MB per file
  - This applies to HSI and SFTP usage, too

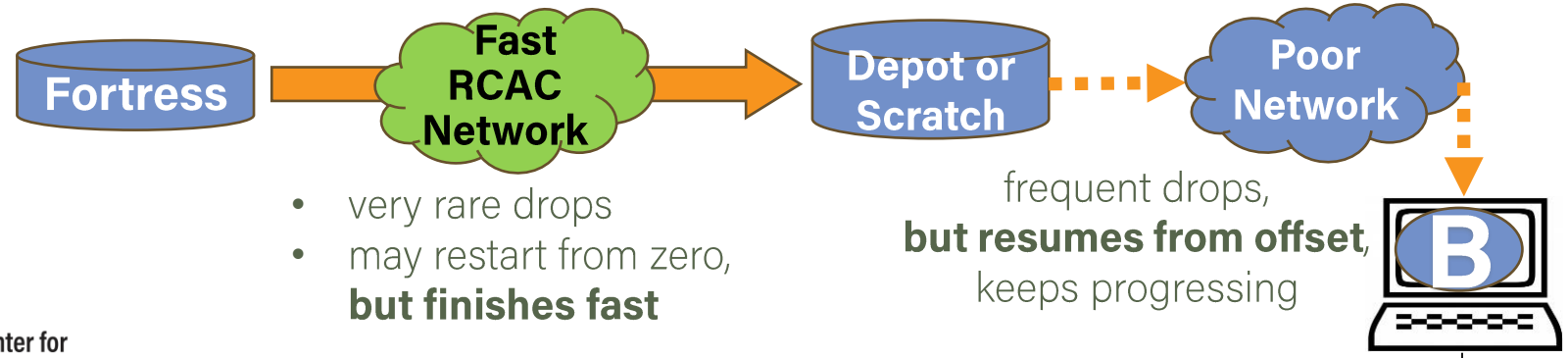
Globus Tips and Tricks

Fortress... try not to retry

- On most endpoints, Globus automagically resumes interrupted transfers from the offset
- Fortress is an exception – Globus restarts the entire file from the beginning
- Getting a large file from Fortress over poor network... good luck



- Two-step to the rescue:
  - Transfer from Fortress to any "normal" filesystem (Depot or cluster scratch)
  - Transfer from this intermediate stop to the final destination



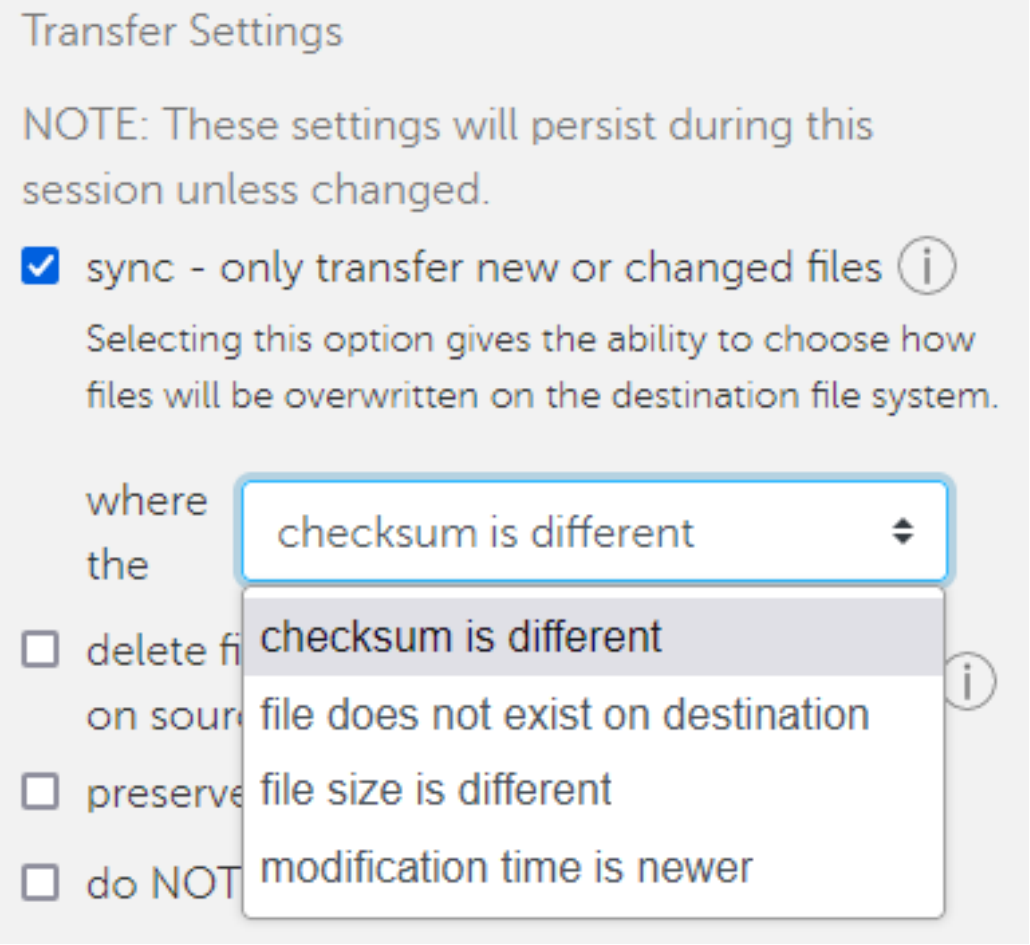
- very rare drops
- may restart from zero, **but finishes fast**

Globus Tips and Tricks

Fortress... sync smart!

- **Do not use *"sync by checksum"* on Fortress!**
- Any other method is ok.

- Remember, Fortress is a tape archive
- Existence, size, modification time are *metadata* (i.e. quick lookup)
- But checksum needs to be ***computed*** (by physically reading the file). I.e. every archived file needs to be *staged from tape* to disk cache and then check-summed to compare.
- I.e. a lot of tape read overhead, no win.



Globus Tips and Tricks

Command-line and developer friendly!

- Command line utility: docs.globus.org/cli/
  - Installed on all RCAC systems
  - Cross-platform, easily installable anywhere
  - Can do anything web GUI does, and more
  - Scriptable transfers and workflows (examples at github.com/globus/automation-examples)

```
$ globus --help
$ globus list-commands
```

- Command line utility for scheduled transfers: pypi.org/project/globus-timer-cli/

```
$ globus-timer --help
```

- Also has an API and a full-blown Python SDK
  - Can use to build CLI and web applications, gateways and portals

Globus Tips and Tricks

Globus use case scenarios for researchers and facilities

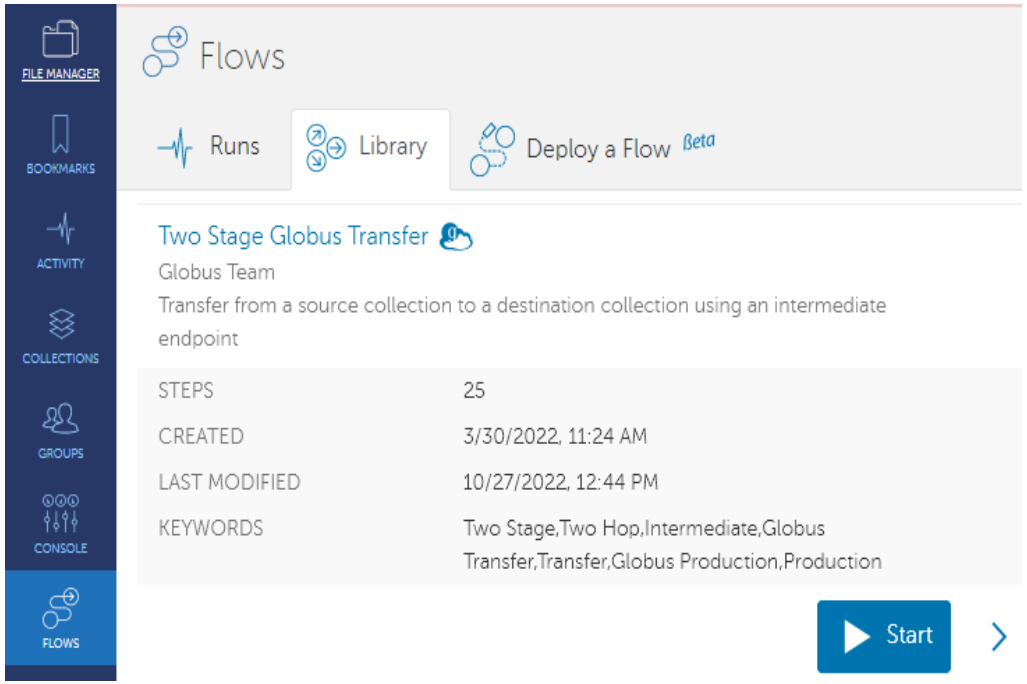
- **Unattended transfers** between internal or external storage resources
- **Share data** with collaborators
- **Publish data** (a.k.a "share with the world")
- Deliver to customers
- Transfer from an instrument PC
- Send to home base from the field
- Make "incoming/outgoing" boxes
- **Fortress made easy!**
- Individual backup subfolders in the lab Fortress space (more flexible and easy to use permissions than with `hsi`/`htar`/Unix groups!)

Tell us your needs - we are very interested in working with you!

Globus Tips and Tricks

New capability: Globus Flows

- A service for defining and executing secure reliable automated data flows at scale
- A flow (workflow) is made of series of steps and a state machine description (*"if this then that"*)
- Steps (actions) are carried out by "action providers" – and can be either in the Globus ecosystem, or outside. E.g.:
  - Data replications
  - Landing zone two-step transfer
  - Acquire – process – archive cycles



Globus Tips and Tricks

Benefits of Purdue Globus subscriptions

Anyone can use Globus' free tier:

- **Unlimited transfers**
- **Unlimited un-managed endpoints**
- "All-or-nothing" sharing (can chose to make things either fully private or fully public)
- Web and CLI access

Purdue subscription adds:

- **Flexible file sharing (private, public, and anything in between)**
- **Unlimited managed shareable endpoints on all RCAC filesystems**
- **Ability to grant managed shareable status to endpoints operated by other Purdue units**
- Globus Plus (extras to enable GCP-to-GCP transfers and sharing from GCP endpoints)
- Globus Console for IT staff
- Globus Support for IT staff

Globus Overview

What Comes Next?

What Comes Next?

Upcoming Seminars

- Research Storage 101: March 10

- Software Installation 101: March 3
- Open OnDemand 101: March 24
- Workflow Automation Tools for Many-Task Computing: March 30

- Running Bioinformatics Analysis in HPC: March 9
- Containerized Bioinformatics Applications for HPC: March 29

- NLP 101: March 31
- Time Series Forecasting 101: April 7

- https://www.rcac.purdue.edu/news/events

THANK YOU

Feel free to reach out to lev@purdue.edu with questions.

Slides and recording are posted at:
https://www.rcac.purdue.edu/training/globus

General help: rcac-help@purdue.edu

Coffee Hour: https://www.rcac.purdue.edu/coffee