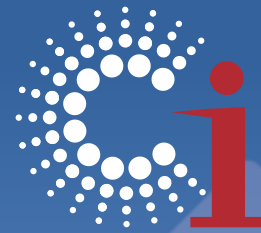




globus online



Computation Institute

# Cloud Based Services for Science

**Steve Tuecke**

Computation Institute

University of Chicago and Argonne National Laboratory



# Cloud Layers

Software-as-a-Service (SaaS)

Platform-as-a-Service (PaaS)

Infrastructure-as-a-Service (IaaS)



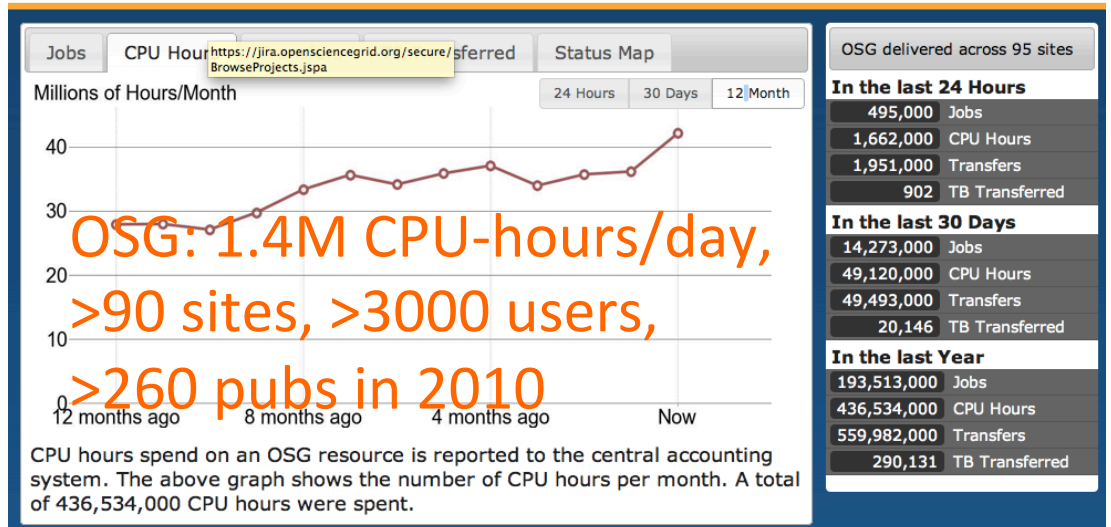
# Big science has achieved big successes with advanced community services



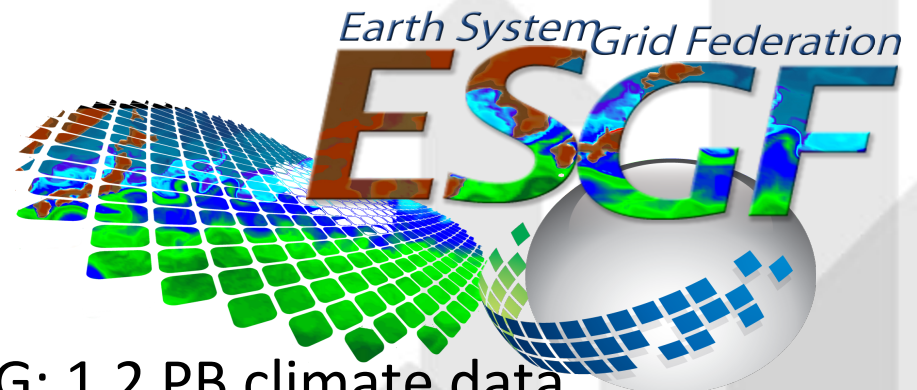
LIGO: 1 PB data in last science run, distributed worldwide



A national, distributed computing partnership for data-intensive research



- Substantial teams
- Sustained effort
- Leverage common technology
- Application-specific solutions
- Production focus



ESG: 1.2 PB climate data delivered to 23,000 users; 600+ pubs



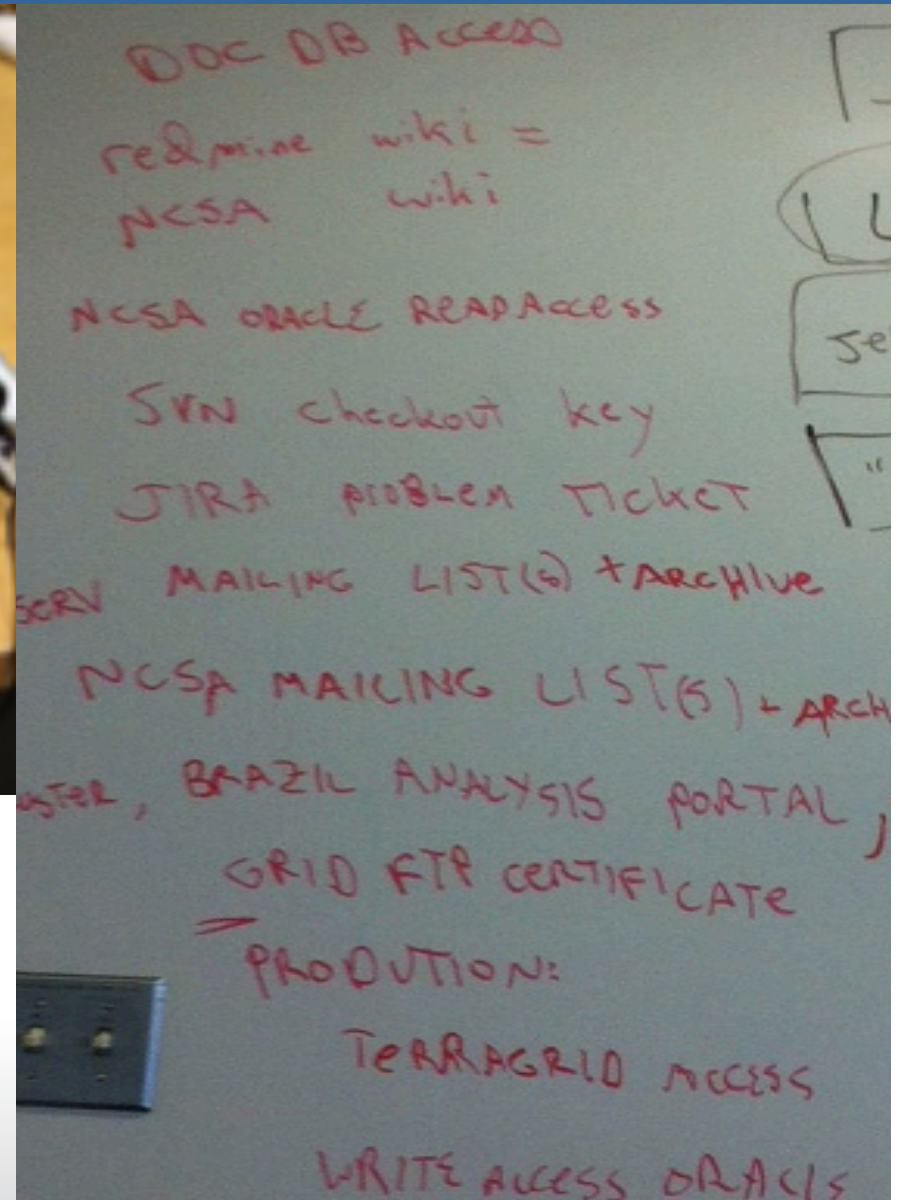
Built on Globus Toolkit and Condor software



## But small and medium science is suffering



- Data deluge
- Ad-hoc solutions
- Inadequate software, hardware & IT staff





# Medium science: Dark Energy Survey

Blanco 4m on Cerro Tololo

- **Every night, they receive 100,000 files in Illinois**
- **They transmit files to Texas for analysis ... then move results back to Illinois ... and make them available to users**
- **Process must be reliable, routine, and efficient**
- **The cyberinfrastructure team is not large!**



Image credit: Roger Smith/NOAO/AURA/NSF



# Time-consuming Tasks in Research

- Run experiments
- Collect data
- Manage data
- Move data
- Acquire computers
- Analyze data
- Run simulations
- Compare experiment with simulation
- Search the literature
- Communicate with colleagues
- Publish papers
- Find, configure, install relevant software
- Find, access, analyze relevant data
- Order supplies
- Write proposals
- Write reports
- ...



## Rethinking how we provide **research IT**

Accelerate discovery and innovation worldwide by providing **research IT as a service**



Leverage the **cloud** to

- provide millions of researchers with unprecedented access to powerful tools;
- enable a massive shortening of cycle times in time-consuming research processes; and
- **reduce research IT costs dramatically via economies of scale**



## Why SaaS?

Software-as-a-Service (SaaS)

Platform-as-a-Service (PaaS)

Infrastructure-as-a-Service (IaaS)

- **Deliver advanced functionality that:**
  - Requires no user software installation or operation
    - Minimal IT proficiency required
  - Can be cheaply and incrementally adopted
    - Usage-based subscription pricing; no big up-front costs
  - Consolidates troubleshooting and support
    - An expert group can proactively detect and correct problems
  - Utilizes an efficient software delivery lifecycle
    - Updates developed, tested and deployed quickly
- **Dominates commercial & consumer markets**
  - What about the research market?





# Towards "research IT as a service"

## Research Data Management-as-a-Service



Globus Transfer

Globus Storage

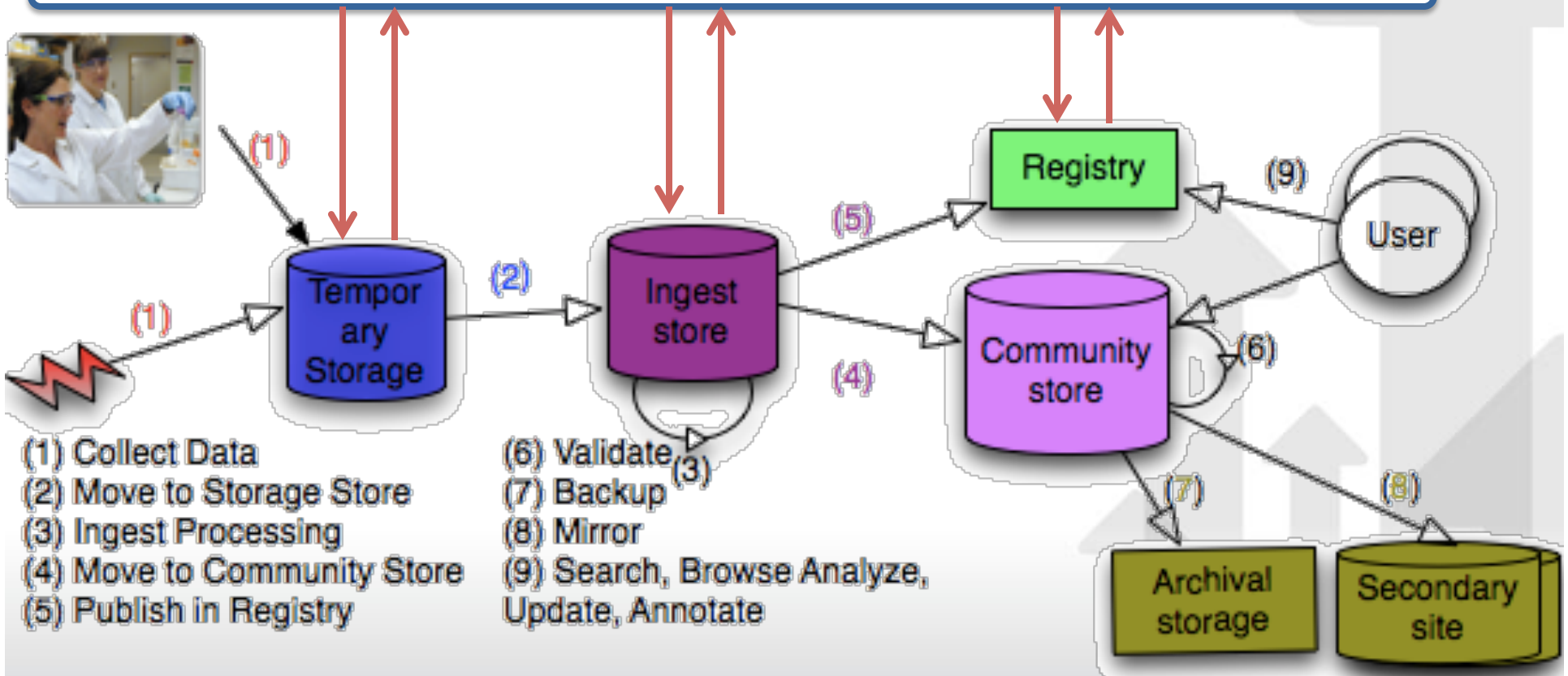
Globus Collaborate

Globus Compute

...SaaS

Globus Integrate

...PaaS





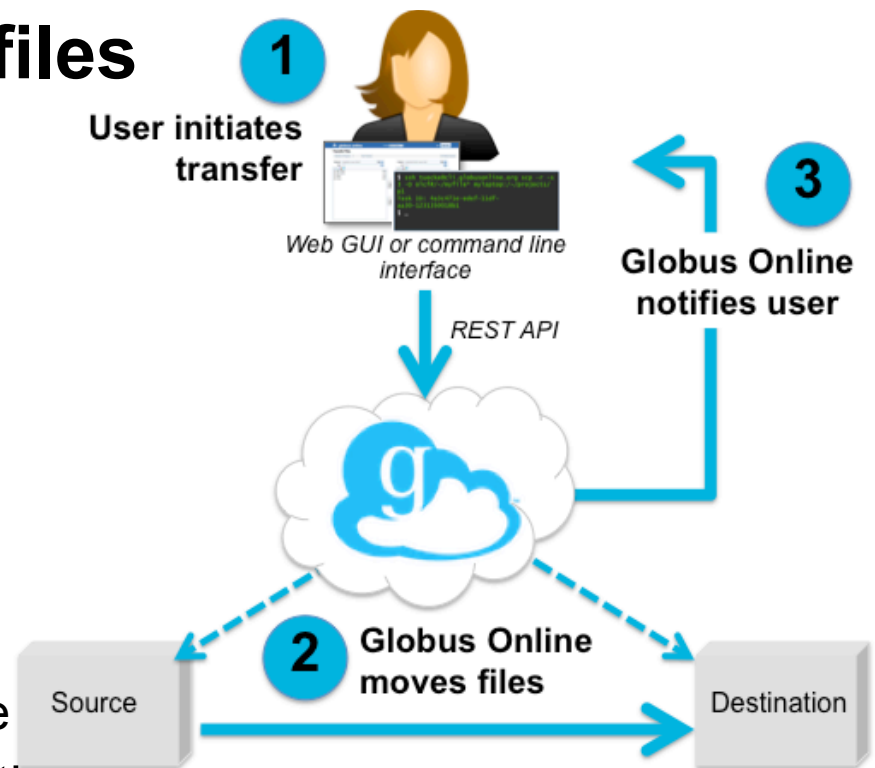
# Globus Transfer: For when you want to...

- **Transfer and synchronize files**

- Easy “fire-and-forget” transfers
- Automatic fault recovery
- High performance
- Across multiple security domains

- **Minimize IT costs**

- Software as a Service (SaaS)
  - No client software installation
  - New features automatically available
- Consolidated support & troubleshooting
- Simple endpoint installation with Globus Connect and GridFTP

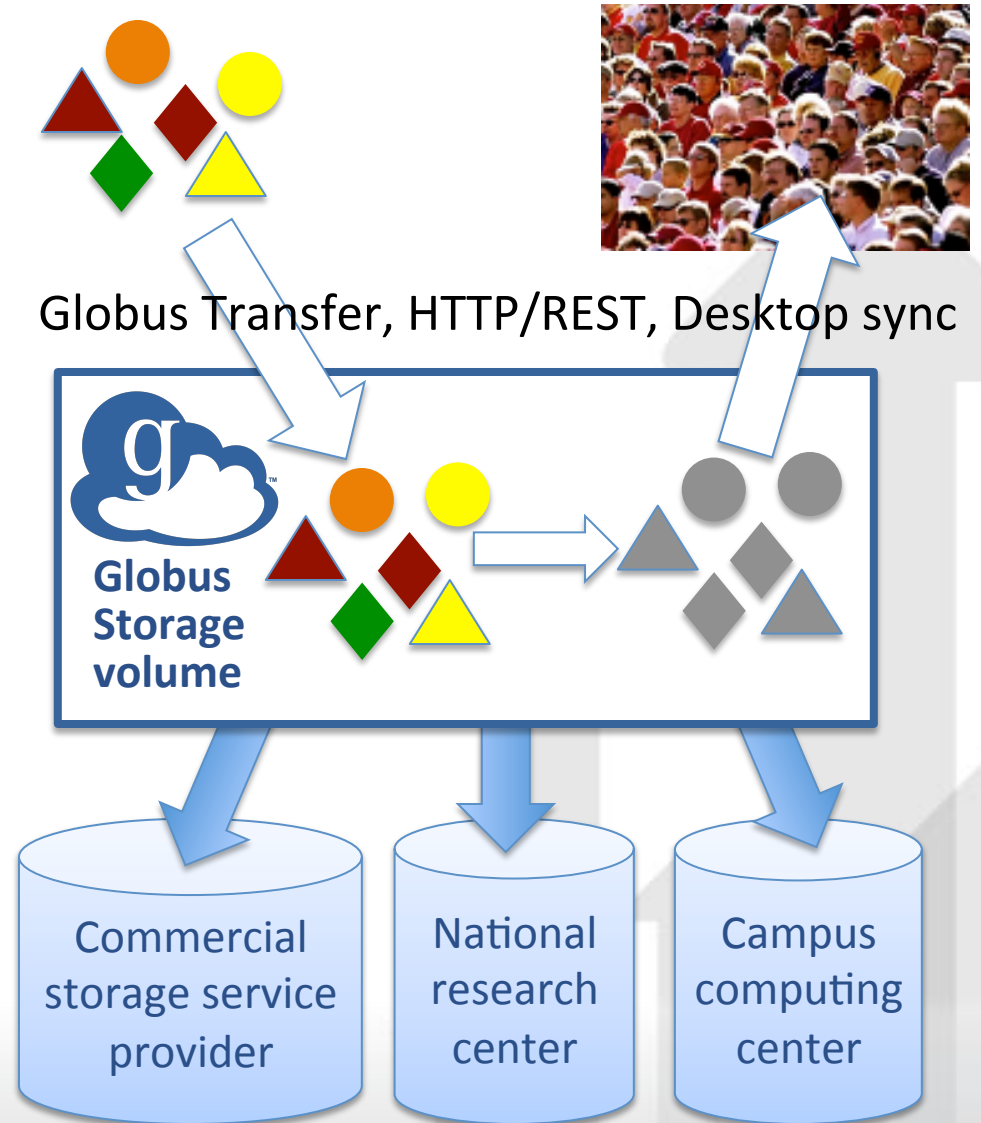


**>4,500 registered users, 4PB / 400M files transferred**



# Globus Storage: For when you want to ...

- **Place** your data where you want
- **Access** it from anywhere via different protocols
- **Update** it, **version** it, and take **snapshots**
- **Share** versions with who you want
- **Synchronize** among locations





Alpha

# Globus Collaborate: For when you want to...

Join with a few or many people to:

- **Share documents**
- **Track tasks**
- **Send email**
- **Share data**
- **Do whatever**

With:

- **Common groups**
- **Delegated management**

home | who we are | latest research | collaborators | Industrial collaborators | our environment | opportunities

Providing transformative theoretical and computational methods relating the molecular scale to cellular processes

Research Sponsors  
National Science Foundation  
THE UNIVERSITY OF CHICAGO

This NSF Center for Chemical Innovation (CCI) project is focused on developing a novel, systematic, and transformative scientific capability for the scientific community. The project will combine conceptual advances in statistical mechanics and condensed phase dynamics with computer simulation methodology and cyberinfrastructure.

**Scientific Goals and Impacts**  
o Develop a rigorous theoretical and computational methodology to describe biomolecular systems at

**Broader Impacts**  
o Innovations in computational software will be disseminated publicly and

**A CMTS Case Study**  
*Actin, a cytoskeletal protein, is an ideal example*



Proposed

# Globus Compute: For when you want to...

- **Run computational jobs**
  - On national facilities (e.g., OSG, XSEDE), campus clusters, lab and personal computers, cloud IaaS
  - Focus on high throughput jobs
- **Minimize IT costs**
  - SaaS, consolidated support & troubleshooting, etc.
- **Minimize end-user expertise required**
  - Simple GUIs for submission, management, policies

Based on



**Condor**  
High Throughput Computing

[www.globusonline.org](http://www.globusonline.org)



# PaaS for Research

Software-as-a-Service (SaaS)

Platform-as-a-Service (PaaS)

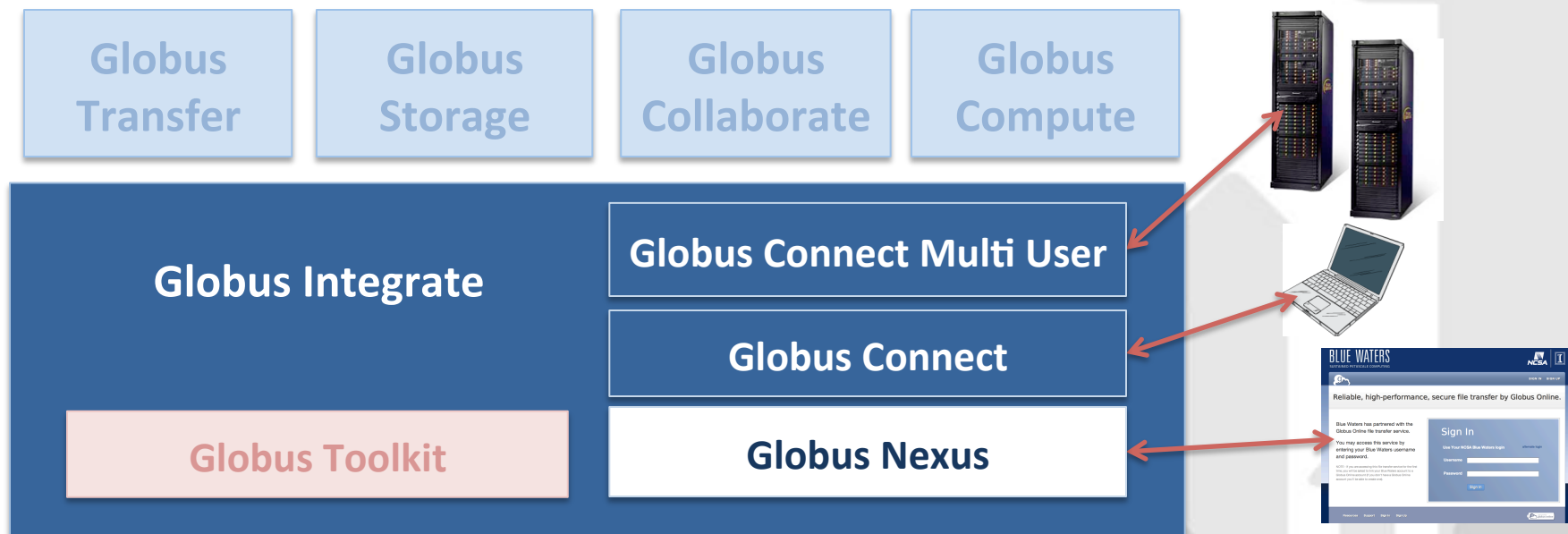
Infrastructure-as-a-Service (IaaS)

- **No one SaaS provider can deliver it all**
- **Must create ecosystem that:**
  - Allows any SaaS provider to easily participate
  - Dramatically reduces the cost of creating and operating service within the ecosystem
  - Provides seamless user experience across services
  - Agnostic to / works across any cloud IaaS provider
- **Ecosystem requires Platform as a Service**
  - Target the unique needs of the research community



# Globus Integrate: For when you want to...

- Integrate with the Globus research cloud ecosystem
- Write programs that access/manage:
  - user identities, profiles, groups, resources
  - data, compute and collaboration



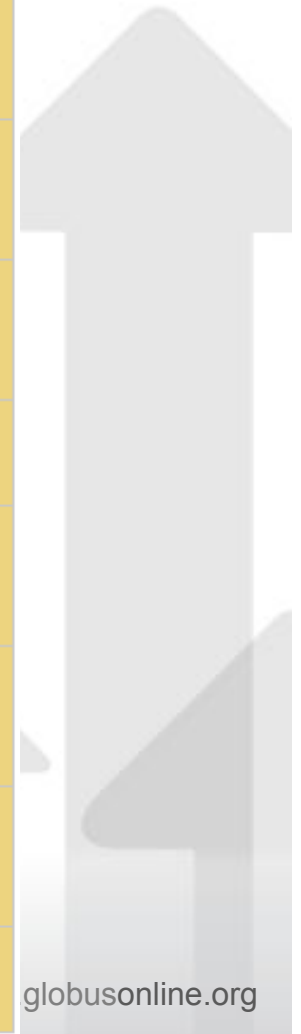
... via REST APIs and command line programs



# Sustainability

## Globus Transfer Premium Plans

|  | Standard                         | Silver<br>Sign up now                               | Gold<br>Sign up now                    |
|--|----------------------------------|---|--|
| <b>Support service level</b>   | Monday-Friday<br>8am-5pm Central | Monday-Friday<br>8am-5pm Central<br>4-hour response | 24hrs x 7 days/week<br>2-hour response |
| <b>Globus Connect Multi-User (GCMU)</b><br>What's this?              | Yes                              | Yes   | Yes                                    |
| <b>Concurrent transfers</b><br>What's this?                          | 2 per user                       | Unlimited to/from your endpoints                    | Unlimited to/from your endpoints       |
| <b>Flight Control endpoint operations console</b><br>What's this?    | —                                | Yes   | Yes                                    |
| <b>Branded interface with your own DNS name</b><br>What's this?      | —                                | Yes   | Yes                                    |
| <b>Single Sign-On with default identity provider</b><br>What's this? | —                                | Yes   | Yes                                    |
| <b>Pricing</b>   | Free                             | \$1,000/month or<br>\$10,000/year                   | \$7,500/month or<br>\$75,000/year      |







## For More Information

- **Visit <https://www.globusonline.org/signup> to:**
  - Get a free account and start moving files
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  - Papers, Case Studies
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  - Help getting started & using the service
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