Managing your Globus Deployment

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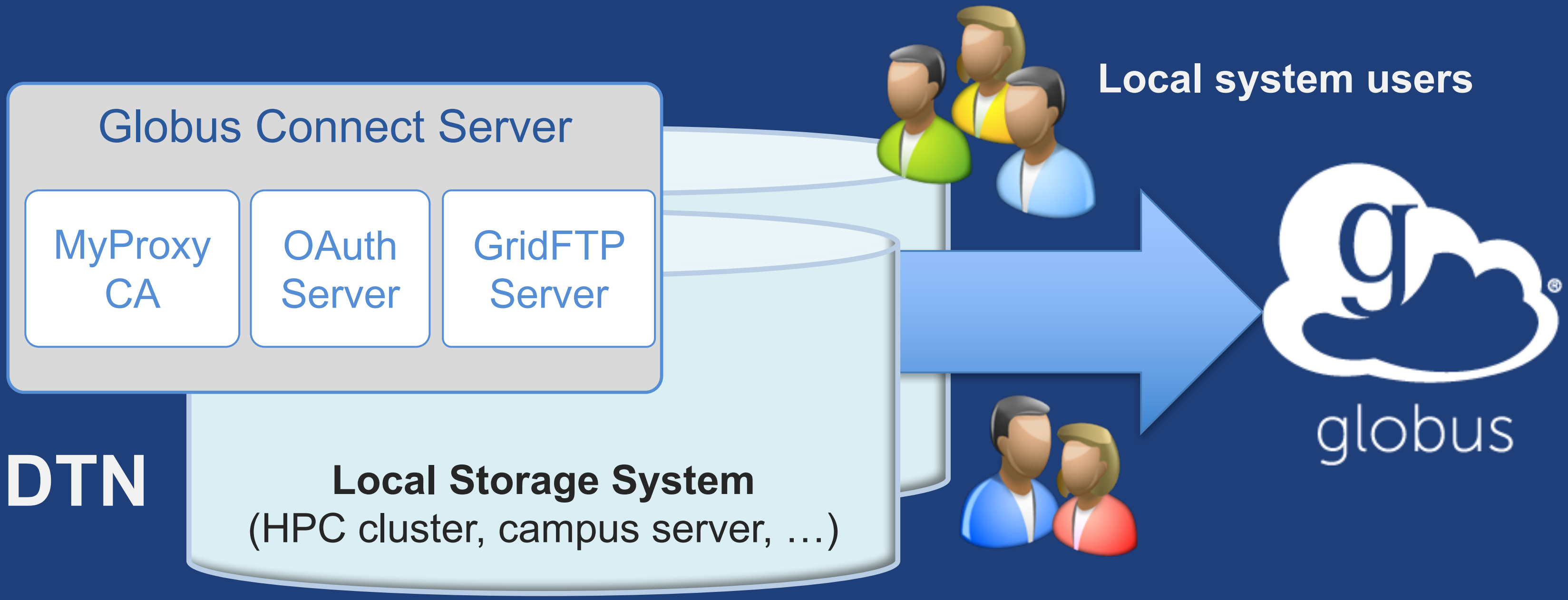
Slides and useful links:

globusworld.org/**admin-tutorial**

Enabling your storage system:

Globus Connect Server

Globus Connect Server



- Create endpoint on practically any filesystem
- Enable access for all users with local accounts
- Native packages: RPMs and DEBs

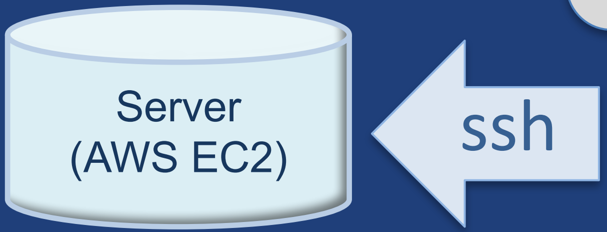
Demonstration

- Creating a Globus endpoint on your storage system
- In this example, storage system = Amazon EC2 server
- Akin to what you would do on your DTN

Step 0: Create a Globus ID

- **Installation and configuration of Globus Connect Server requires a Globus ID**
- **Go to `globusid.org`**
- **Click “`create a Globus ID`”**

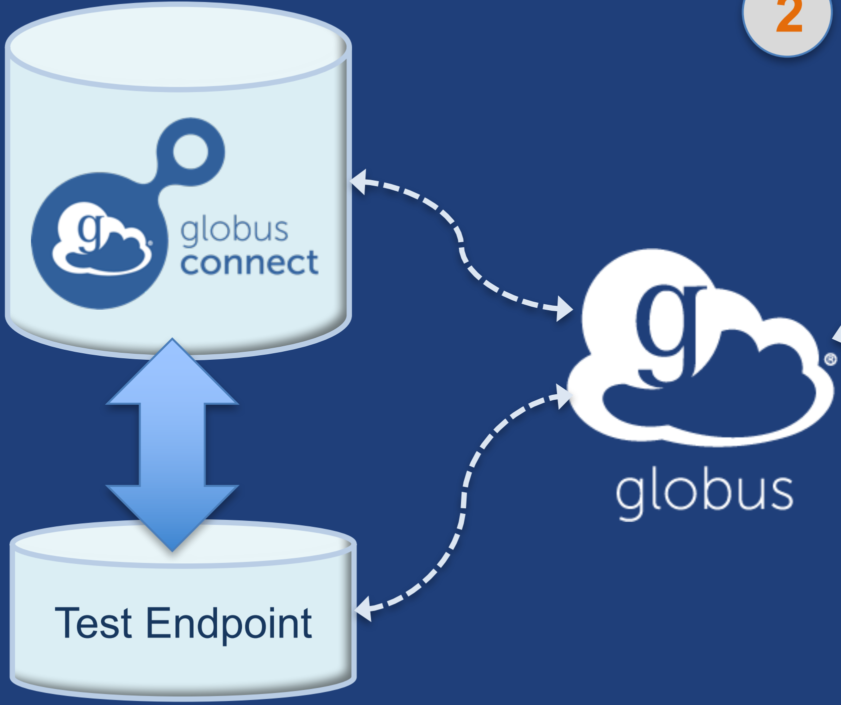
What we are going to do:

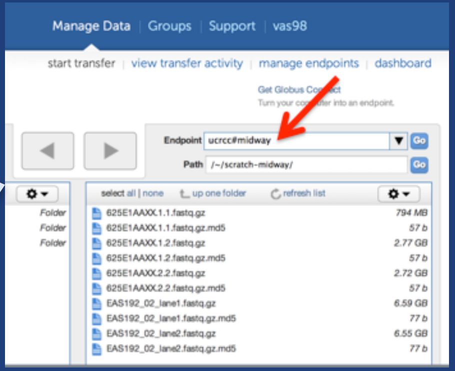


1 Install Globus Connect Server

- Access server as user “**campusadmin**”
- Update repo
- Install package
- Setup Globus Connect Server

2 Log into Globus




Manage Data | Groups | Support | vas98
start transfer | view transfer activity | manage endpoints | dashboard
Get Globus Connect
Turn your computer into an endpoint.
◀ ▶
Go
Go
select all | none
up one folder
refresh list
Folder
Folder
Folder

Endpoint: ucrcc#midway

Path: /~/scratch-midway/

625E1AAXX.1.1.fastq.gz	794 MB
625E1AAXX.1.1.fastq.gz.md5	57 b
625E1AAXX.1.2.fastq.gz	2.77 GB
625E1AAXX.1.2.fastq.gz.md5	57 b
625E1AAXX.2.2.fastq.gz	2.72 GB
625E1AAXX.2.2.fastq.gz.md5	57 b
EAS192_02_lane1.fastq.gz	6.59 GB
EAS192_02_lane1.fastq.gz.md5	77 b
EAS192_02_lane2.fastq.gz	6.55 GB
EAS192_02_lane2.fastq.gz.md5	77 b

3 Access the newly created endpoint (as user ‘researcher’)

4 Transfer a file

Access your host

- **Create a Globus ID**
  - Optional: associate it with your Globus account
- **Get the DNS for your EC2 server**
- **Log in as user 'campusadmin':**

```
ssh campusadmin@<EC2_instance_IP_address>
```

- **NB: Please** `sudo su` **before continuing**
  - User 'campusadmin' has sudo privileges

Step 3: Install Globus Connect Server

Cheatsheet: globusworld.org/admin-tutorial

```
$ sudo su
$ curl -LOs http://toolkit.globus.org/ftppub/globus-connect-server/globus-connect-server-repo_latest_all.deb
$ dpkg -i globus-connect-server-repo_latest_all.deb
$ apt-get update
$ apt-get -y install globus-connect-server
$ globus-connect-server-setup
```

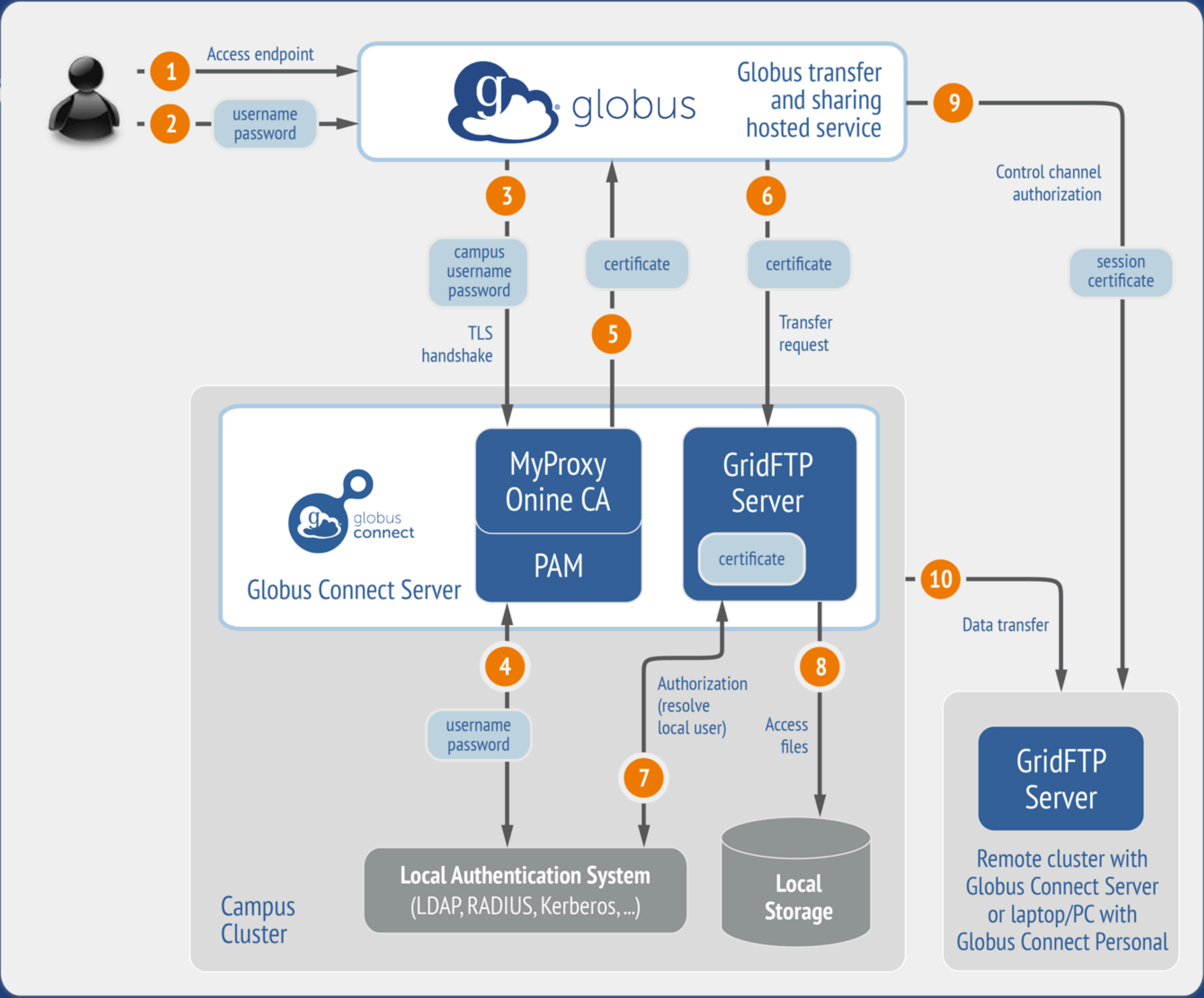
⮤ Use your Globus ID username/password when prompted

You have a working Globus endpoint!

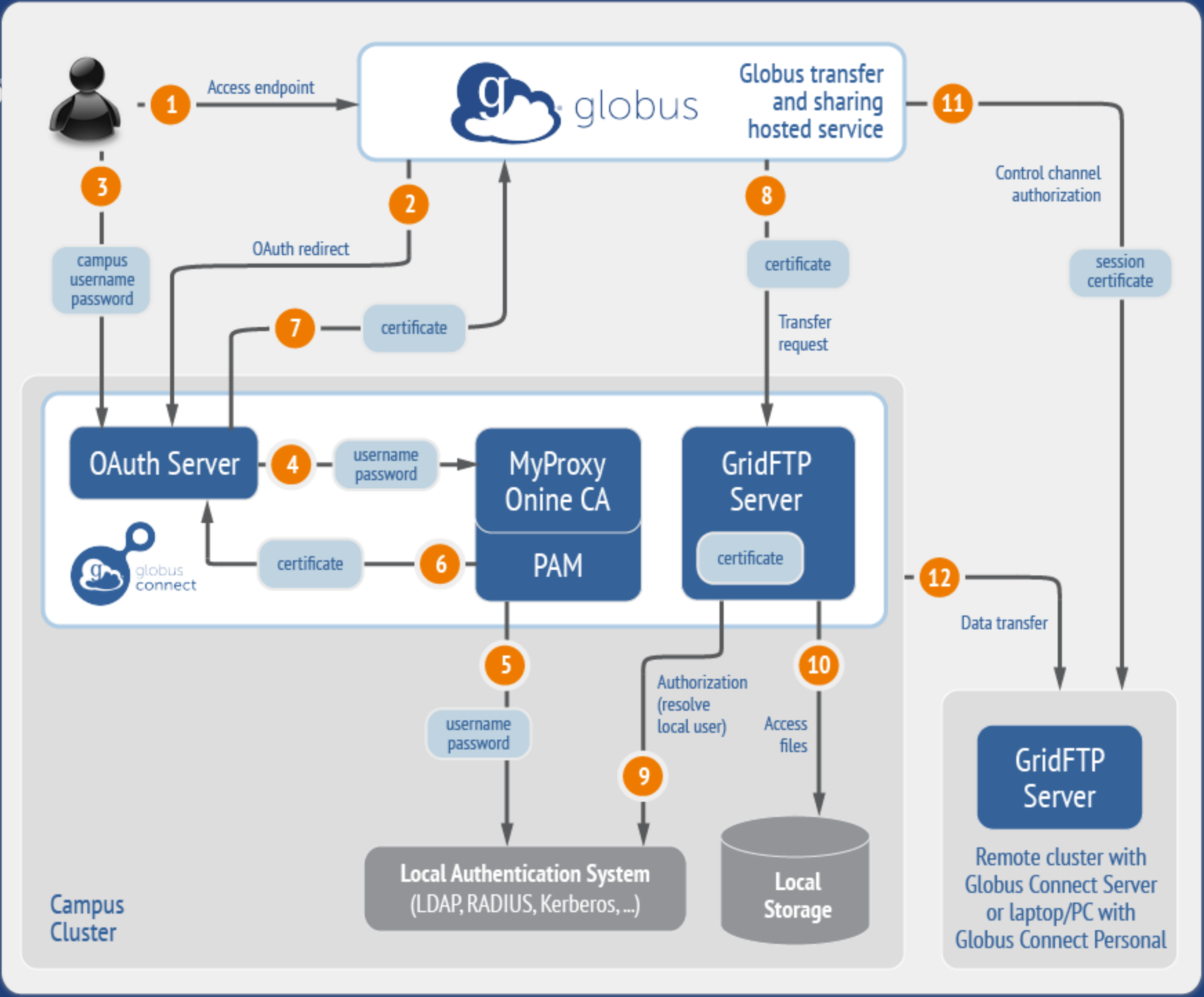
Access the Globus endpoint

- **Go to Manage Data → Transfer Files**
- **Access the endpoint you just created**
  - Search for your EC2 DNS name in the Endpoint field
  - Log in as user "**researcher**" (pwd: **globus2017**); you should see the user's home directory
- **Transfer files to/from a test endpoint (e.g. Globus Tutorial, ESnet) and your endpoint**

Endpoint activation using MyProxy



Endpoint activation using MyProxy OAuth



Ports needed for Globus

- **Inbound: 2811 (control channel)**
- **Inbound: 7512 (MyProxy), 443 (OAuth)**
- **Inbound: 50000-51000 (data channel)**
- **If restricting outbound connections, allow connections from:**
  - 80, 2223 (used during install/config)
  - 50000-51000 (GridFTP data channel)
- **Futures: single-port GridFTP**

Configuring Globus Connect Server

- **Configuration options specified in:**

  ```
  /etc/globus-connect-server.conf
  ```

- **To enable changes you must run:**

  ```
  globus-connect-server-setup
  ```

- **“Rinse and repeat”**

Configuration file walkthrough

- **Structure based on .ini format**

```
[Section]
Option
```

- **Commonly configured options:**

```
Name
Public
RestrictedPaths
Sharing
SharingRestrictedPaths
IdentityMethod (CILogon, Oauth)
```

Exercise: Make your endpoint visible

- **Set** `Public = true`
- **Run** **`globus-connect-server-setup`**
- **Edit endpoint attributes**
  - Change the name to something useful, e.g. <your_name> EC2 Endpoint
- **Find your neighbor’s endpoint**
  - You can access it too ☺

Enabling sharing on an endpoint

- Set `Sharing = True`
- Run `globus-connect-server-setup`
- Go to the Transfer Files page
- Select the endpoint
- Create shared endpoints and grant access to other Globus users*

* Note: Creation of shared endpoints requires a **Globus subscription** for the managed endpoint

Path Restriction

- **Default configuration:**
  - All paths allowed, access control handled by the OS
- **Use `RestrictPaths` to customize**
  - Specifies a comma separated list of full paths that clients may access
  - Each path may be prefixed by R (read) and/or W (write), or N (none) to explicitly deny access to a path
  - '~' for authenticated user's home directory, and * may be used for simple wildcard matching.
- **e.g. Full access to home directory, read access to /data:**
  - `RestrictPaths = RW~,R/data`
- **e.g. Full access to home directory, deny hidden files:**
  - `RestrictPaths = RW~,N~/.*`

Exercise: Restrict access

- **Set** `RestrictPaths=RW~,N~/archive`
- **Run** **`globus-connect-server-setup`**
- **Access your endpoint as ‘researcher’**
- **What’s changed?**

Limit sharing to specific accounts

- `SharingUsersAllow =`
- `SharingGroupsAllow =`
- `SharingUsersDeny =`
- `SharingGroupsDeny =`

Sharing Path Restriction

- **Restrict paths where users can create shared endpoints**
- **Use `SharingRestrictPaths` to customize**
  - Same syntax as `RestrictPaths`
- **e.g. Full access to home directory, deny hidden files:**
  - `SharingRestrictPaths = RW~,N~/.*`
- **e.g. Full access to public folder under home directory:**
  - `SharingRestrictPaths = RW~/public`
- **e.g. Full access to /proj, read access to /scratch:**
  - `SharingRestrictPaths = RW/proj,R/scratch`

Advanced Configuration

Using MyProxy OAuth server

- **MyProxy without OAuth**
  - Passwords flow via Globus to MyProxy server
  - Globus does not store passwords
  - Still a security concern for many campuses
- **Web-based endpoint activation**
  - Sites run MyProxy OAuth server or use CI Logon
  - Globus gets short-term X.509 credential via MyProxy OAuth protocol

Single Sign-On with InCommon/CILogon

- **Your Shibboleth server must release the ePPN attribute to CILogon**
- **Local resource account names must match institutional ID (InCommon ID)**
- `AuthorizationMethod = CILogon`
- `CILogonIdentityProvider = <institution_listed_in_CILogon_IdP_list>`

Integrating your IdP

- **InCommon members**
  - Must release R&S attributes to CILogon
  - Mapping uses ePPN; can use GridMap

```
AuthorizationMethod = CILogon
CILogonIdentityProvider =
<institution_name_in_CILogon_IdP_list>
```

- **Non-members**
  - IdP must support OpenID Connect
  - Requires Alternate IdP subscription
- **Using an existing MyProxy server**

Managed endpoints and subscriptions

Subscription configuration

- **Subscription manager**
  - Create/upgrade managed endpoints
  - Requires Globus ID linked to Globus account
- **Management console permissions**
  - Independent of subscription manager
  - Map managed endpoint to Globus ID
- **Globus Plus group**
  - Subscription Manager is admin
  - Can grant admin rights to other members

Creating managed endpoints

- Required for sharing, management console, reporting, etc.
- Convert existing endpoint to managed:

```
endpoint-modify --managed-endpoint <endpoint_name>
```

- Must be run by subscription manager, using the Globus CLI
- Important: Re-run `endpoint-modify` after deleting/re-creating endpoint

Demonstration:

Command Line Interface (CLI)

Exercise: Globus CLI

1. **Add your SSH key to your Globus ID**
   - Go to: globusid.org/keys
2. `ssh <globusid>@cli.globusonline.org`
3. **Run** `help` **to see available commands**
4. **Start a transfer and check its** `status`

Managed endpoint activity accessible via management console

- **Monitor all transfers**
- **Pause/resume specific transfers**
- **Add pause conditions with various options**
- **Resume specific tasks overriding pause conditions**
- **Cancel tasks**
- **View sharing ACLs**

Demonstration:
Management console

Endpoint Roles

- **Administrator**: define endpoint and roles
- **Access Manager**: manage ACLs
- **Activity Manager**: perform control tasks
- **Activity Monitor**: view activity

Other Deployment Options

Encryption

- **Requiring encryption on an endpoint**
  - User cannot override
  - Useful for “sensitive” data
- **Globus uses OpenSSL cipher stack as currently configured on your DTN**
- **FIPS-140-2 compliance**
  - Limit number of ciphers used by OpenSSL
  - https://access.redhat.com/solutions/137833

Distributing Globus Connect Server components

- **Globus Connect Server components**
  - globus-connect-server-io, -id, -web
- **Default: -io, –id and –web on single server**
- **Common options**
  - Multiple –io servers for load balancing, failover, and performance
  - No -id server, e.g. third-party IdP such as CILogon
  - -id on separate server, e.g. non-DTN nodes
  - -web on either –id server or separate server for OAuth interface

Setting up multiple –io servers

- **Guidelines**
  - Use the same .conf file on all servers
  - First install on the server running the –id component, then all others

1. **Install Globus Connect Server on all servers**
2. **Edit .conf file on one of the servers and set `[MyProxy] Server` to the hostname of the server you want the –id component installed on**
3. **Copy the configuration file to all servers**
   - `/etc/globus-connect-server.conf`
4. **Run `globus-connect-server-setup` on the server running the –id component**
5. **Run `globus-connect-server-setup` on all other servers**
6. **Repeat steps 2-5 as necessary to update configurations**

Example: Two-node DTN

-id
-io

```
/etc/globus-connect-server.conf
[Endpoint] Name = globus_dtn
[MyProxy] Server = ec2-34-20-29-57.compute-1.amazonaws.com
```

-io

```
/etc/globus-connect-server.conf
[Endpoint] Name = globus_dtn
[MyProxy] Server = ec2-34-20-29-57.compute-1.amazonaws.com
```

Optimizing transfer performance

Balance: performance - reliability

- **In-flight tuning based on transfer profile (#files, sizes)**
- **Request-specific overrides**
  - Concurrency
  - Parallelism
- **Endpoint-specific overrides; especially useful for multi-DTN deployments**
- **Service limits, e.g. concurrent requests**

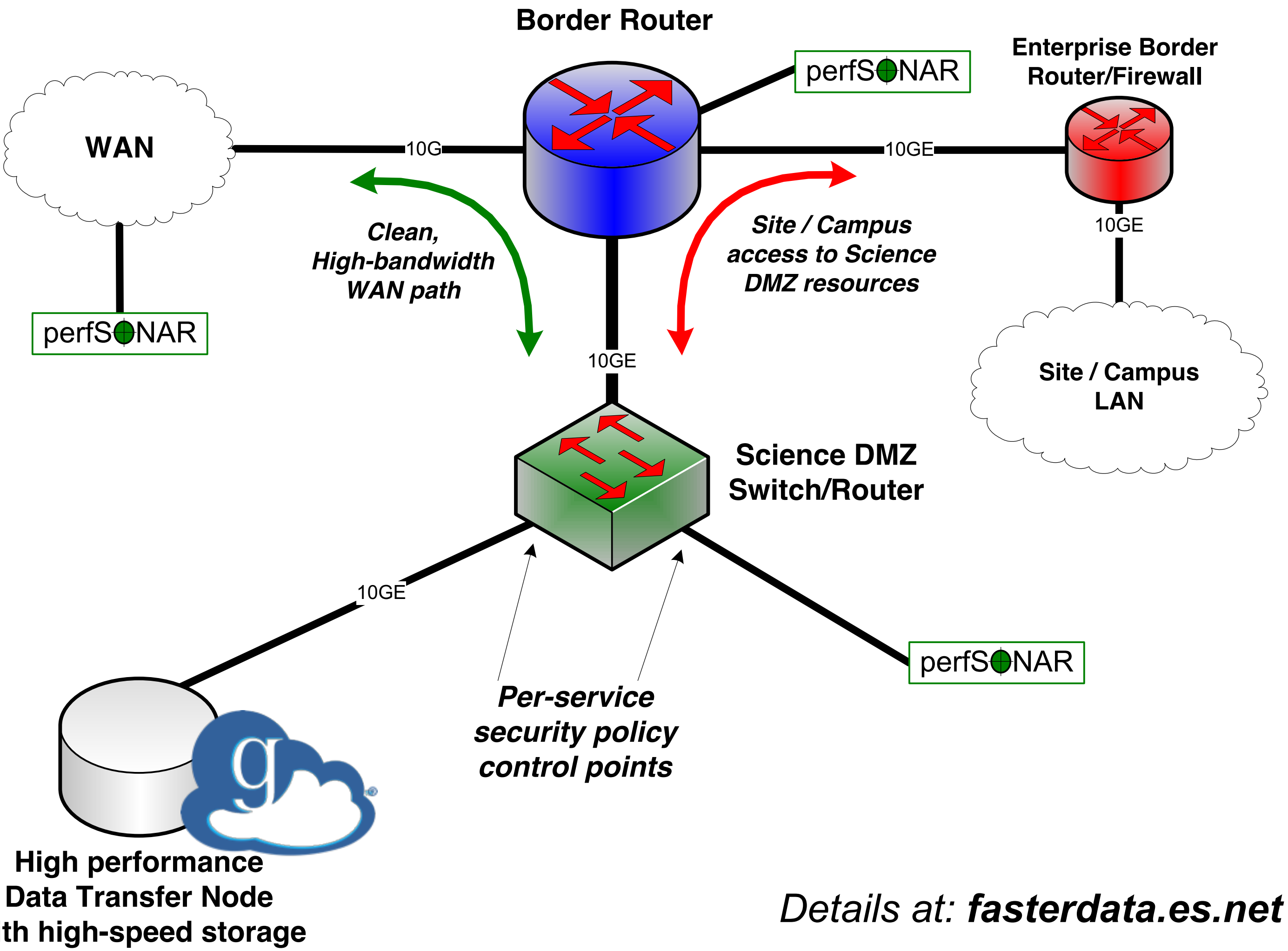
Network Use Parameters

- **Concurrency and parallelism configuration to tune transfers**
- **Maximum and Preferred**
- **Use values set for source and destination to determine parameters for a given transfer**
- **min (max (preferred src, preferred dest), max src, max dest)**

Network paths

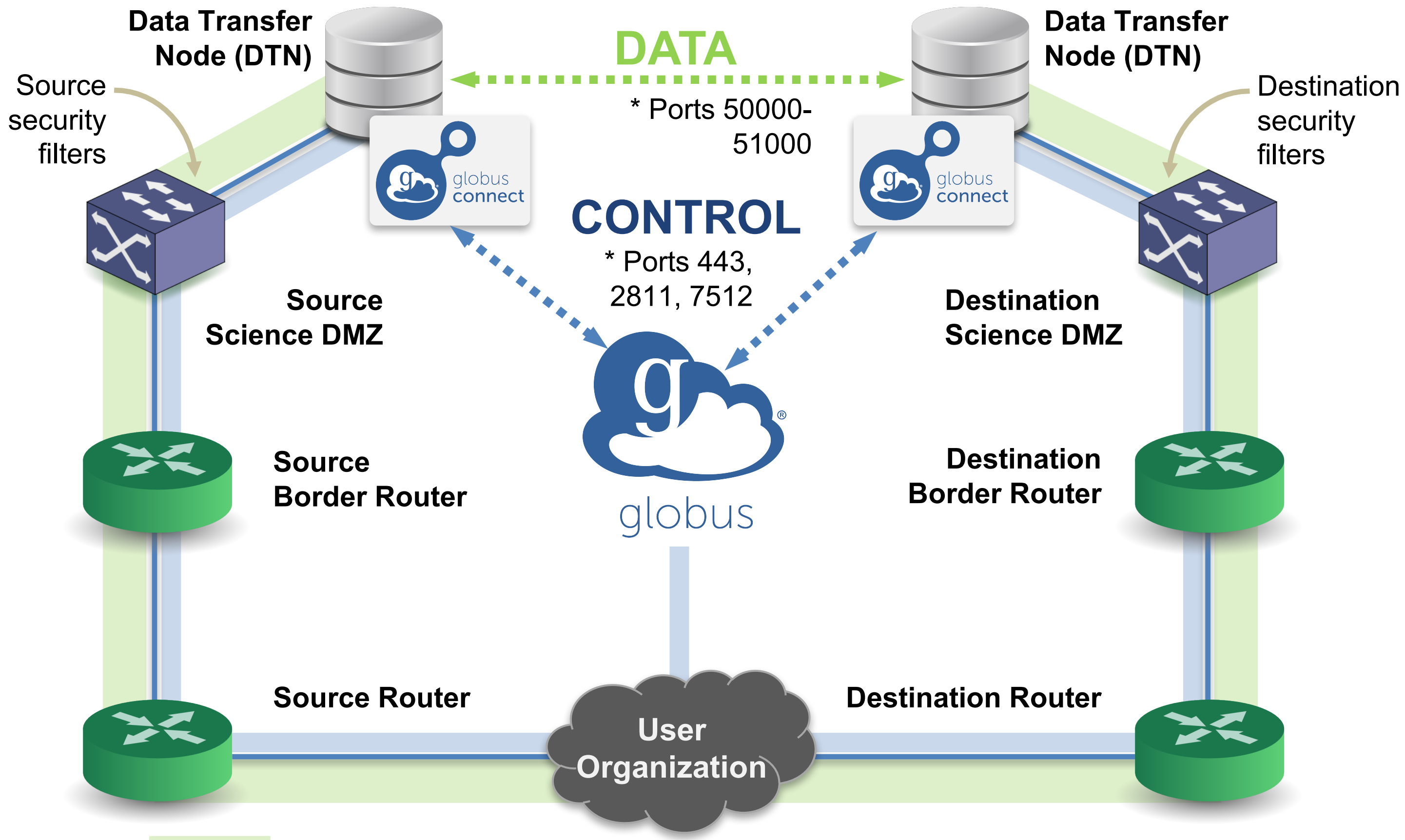
- **Separate control and data interfaces**
- **"DataInterface =" option in globus-connect-server-conf**
- **Common scenario: route data flows over Science DMZ link**

Best-practice deployment


Border Router
perfSONAR
Enterprise Border Router/Firewall
WAN
10G
10GE
10GE
Clean, High-bandwidth WAN path
Site / Campus access to Science DMZ resources
perfSONAR
10GE
Site / Campus LAN
Science DMZ Switch/Router
10GE
perfSONAR
Per-service security policy control points
High performance Data Transfer Node with high-speed storage

Details at: ***fasterdata.es.net***

Network Paths - Illustrative



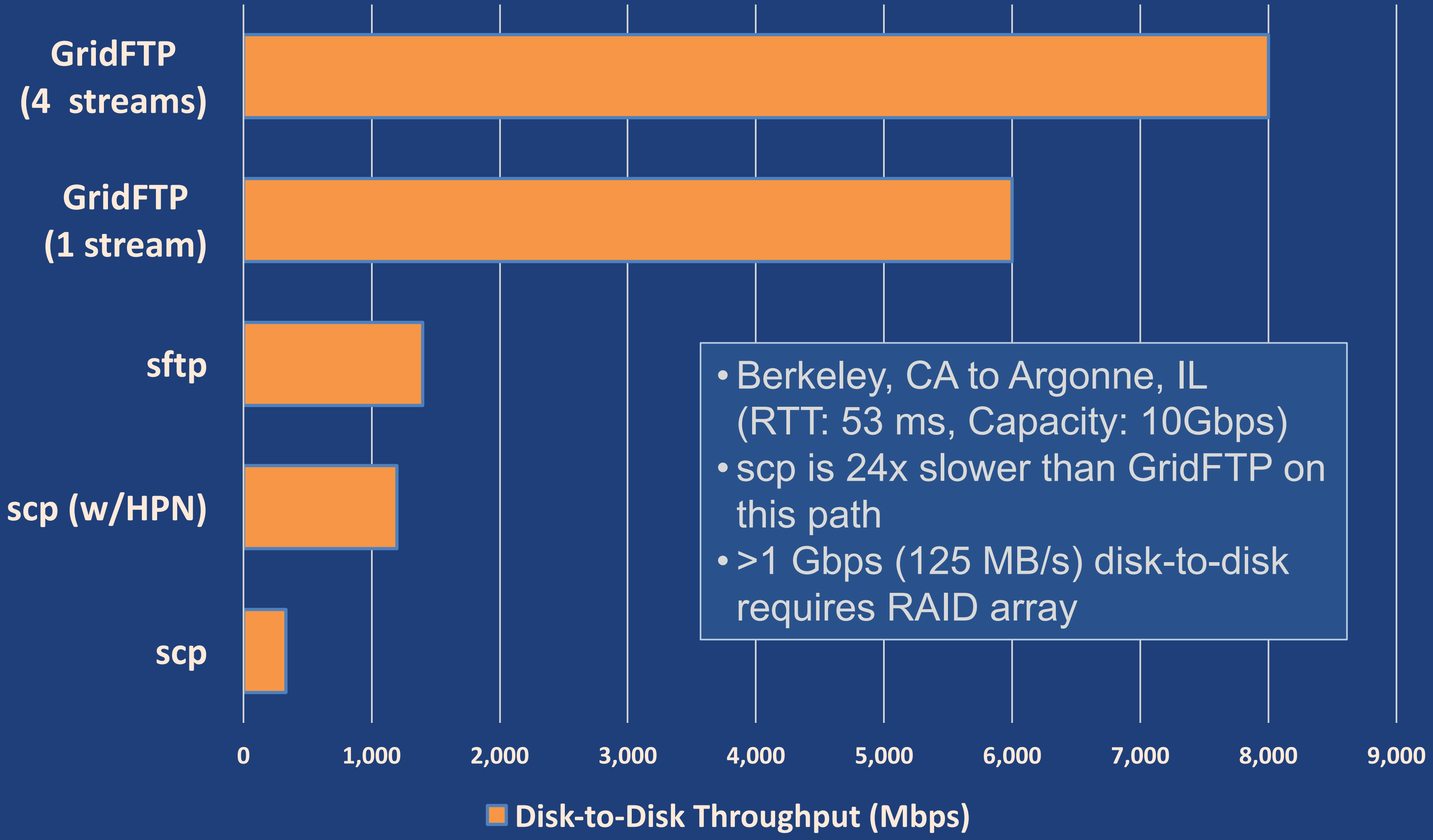
🟩	Physical Data Path	▬	Physical Control Path
▪▪▪▪▪▪▪	Logical Data Path	▪▪▪▪▪▪▪	Logical Control Path

* Please see TCP ports reference: https://docs.globus.org/resource-provider-guide/#open-tcp-ports_section

Illustrative performance

- **20x scp throughput (typical)**
  - >100x demonstrated
- **On par/faster than UDP based tools (NASA JPL study and anecdotal)**
- **Capable of saturating “any” WAN link**
  - Demonstrated 85Gbps sustained disk-to-disk
  - Typically require throttling for QoS

Disk-to-Disk Throughput



- Berkeley, CA to Argonne, IL (RTT: 53 ms, Capacity: 10Gbps)
- scp is 24x slower than GridFTP on this path
- >1 Gbps (125 MB/s) disk-to-disk requires RAID array

Source: ESnet (2016)

For the very brave...

Globus Network Manager

- **Information from GridFTP to facilitate dynamic network changes**
- **Callbacks during GridFTP execution on local DTN**
- **Supplements information available via Globus transfer API**

Globus Network Manager Callbacks

- Pre-listen (binding of socket)
- Post-listen
- Pre-accept/Pre-connect (no Data yet)
- Post-accept/Post-connect (data in flight)
- Pre-close
- Post-close

Network manager use cases

- **Science DMZ Traffic Engineering**
  - Use SDN to dynamically route data path
  - Control path uses traditional route
- **Automated WAN bandwidth reservation**
  - OSCARS, AL2S
- **Note: All this requires custom code**

Discussion

Enable your storage system

- Get started: **docs.globus.org/how-to**
- Install and configure Globus Connect Server: **docs.globus.org/resource-provider-guide/**
- Need help? **support.globus.org**
- Mailing Lists: **globus.org/mailing-lists**
- Subscribe to help us make Globus self-sustaining: **globus.org/provider-plans**
- Follow us: **@globusonline**