Globus Toolkit

Enhancing and Supporting GridFTP:
An Essential Component of
DOE High-speed Networking

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What is GridFTP?

- **Standard workhorse for large data movement in distributed science projects across DOE and worldwide**
  - July 2014: 5,149 GridFTP servers reported 596 million operations and 32.4 petabytes moved

- **GridFTP protocol extends FTP for:**
  - High-performance
  - Strong security
  - Reliability

- **Globus GridFTP server**
  - Mature, widely used implementation of GridFTP

DOE use cases driving GridFTP

- **Globus service driving GridFTP transfers**
  - NERSC: Recommended method for transferring files to/from GPFS file systems and HPSS
  - ALCF: User remote file transfer to/from GPFS
  - APS, ALS: Distributed instrument data to users worldwide
  - ESnet DTNs
  - Etc.
- **Science communities with custom clients**
  - E.g. HEP, ESG

Globus service is a GridFTP client

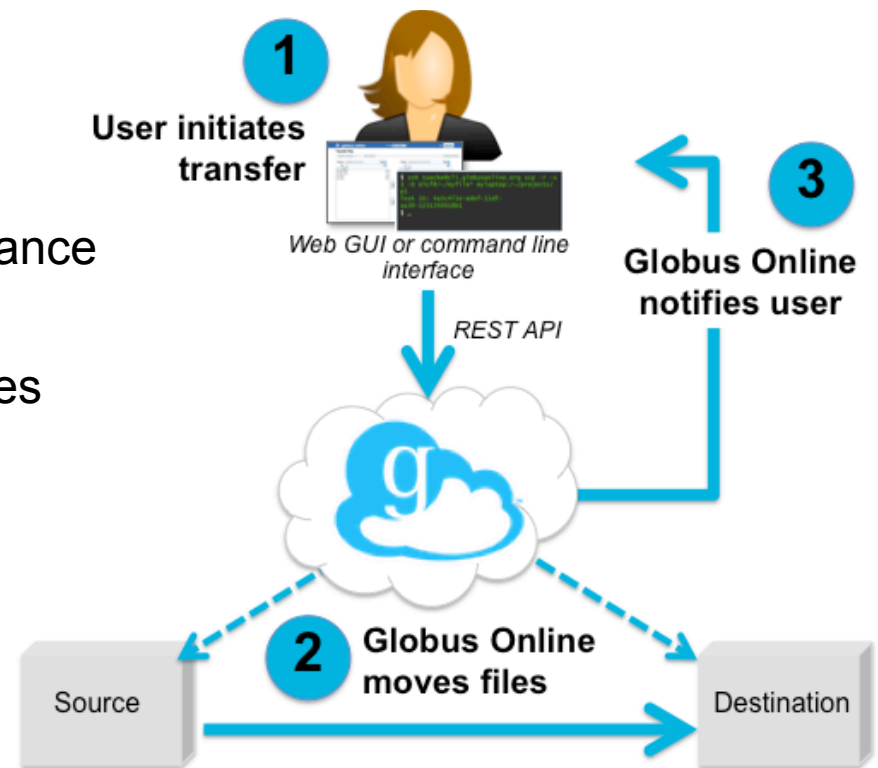- **Move, replicate, share files**
  - Easy "fire-and-forget" transfers
  - Share with any Globus user or group
  - Automatic fault recovery & high performance
  - Across multiple security domains
  - Web, command line, and REST interfaces

- **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

- **>15k registered users, >60PB & 3B files moved**

- **Recommended by ESnet, NERSC, ALCF, XSEDE, Blue Waters, NCAR, many Universities**

1 User initiates transfer

Web GUI or command line interface

REST API

3 Globus Online notifies user

2 Globus Online moves files

Source

Destination

Enhancing and Supporting GridFTP Project Objectives

- **Leverage next-generation networks and multi-core processors**
  - Support big data transfer needs of supercomputers and scientific instruments
  - Not just big files, but lots of small files (LOSF), and end-to-end checksum verification

- **Improve support for firewalls and NATs**

- **Simplify ease of use and administration**

- **Support DOE facilities and scientists**

Accomplishments

- **1 Petabyte transferred per day**
- **Security and firewall enhancements**
- **Native packaging and simple installer, dramatically reducing install time**
- **Improved mass storage system support**
- **Many releases and updates, with dozens of fixes and requested features**

Leverage next-generation networks and multi-core processors

- **Performance study of multi-threaded, secure transfers**
  - Gayane Vardoyan, Rajkumar Kettimuthu, Michael Link, Steven Tuecke, "Characterizing Throughput Bottlenecks for Secure GridFTP Transfers", *Proceedings of the International Conference on Computing, Networking and Communications*, January 2013.

- **Fixed multi-threading bugs**

- **Improved pipelining to mask control channel latency**
  - Improves LOSF, checksum, and other workflow performance

- **UDT supported on most platforms**

- **New mode F solves mode E connection directionality problem, which causes fallback to mode S with NATs**

- **UDT over UDP with NAT traversal using STUN & ICE**
  - Available on most platforms
  - Used by Globus with Globus Connect Personal

- **Single-port GridFTP server (in alpha)**
  - Mode F allows data channel connection over same port as control channel; no ephemeral ports
  - Solves mode E connection directionality problem
  - Code & specs to be released this fall

UDT over UDP with NAT traversal

Source

SITE UPAS 0

200 tGpe prsJ1JkvZgn60w1PeCgYOX
1,2013266431,10.1.1.128,58646,host

    [foundation,priority,address,port,type]

    [HOST->"host"]

    [SERVER REFLEXIVE->"srflx"]

    [PEER REFLEXIVE->"prflx"]

    [RELAYED->"relay"]

SITE UPRT
fOW8 65yXCLBY4r/6/Y9mmYtMb/
1,2013266431,192.168.1.10,54003,host

200 OK

PORT 192.168.1.10,210,243

200 PORT Command successful.

[transfer as usual]

Destination

SITE UPAS 1

200 fOW8 65yXCLBY4r/6/Y9mmYtMb/
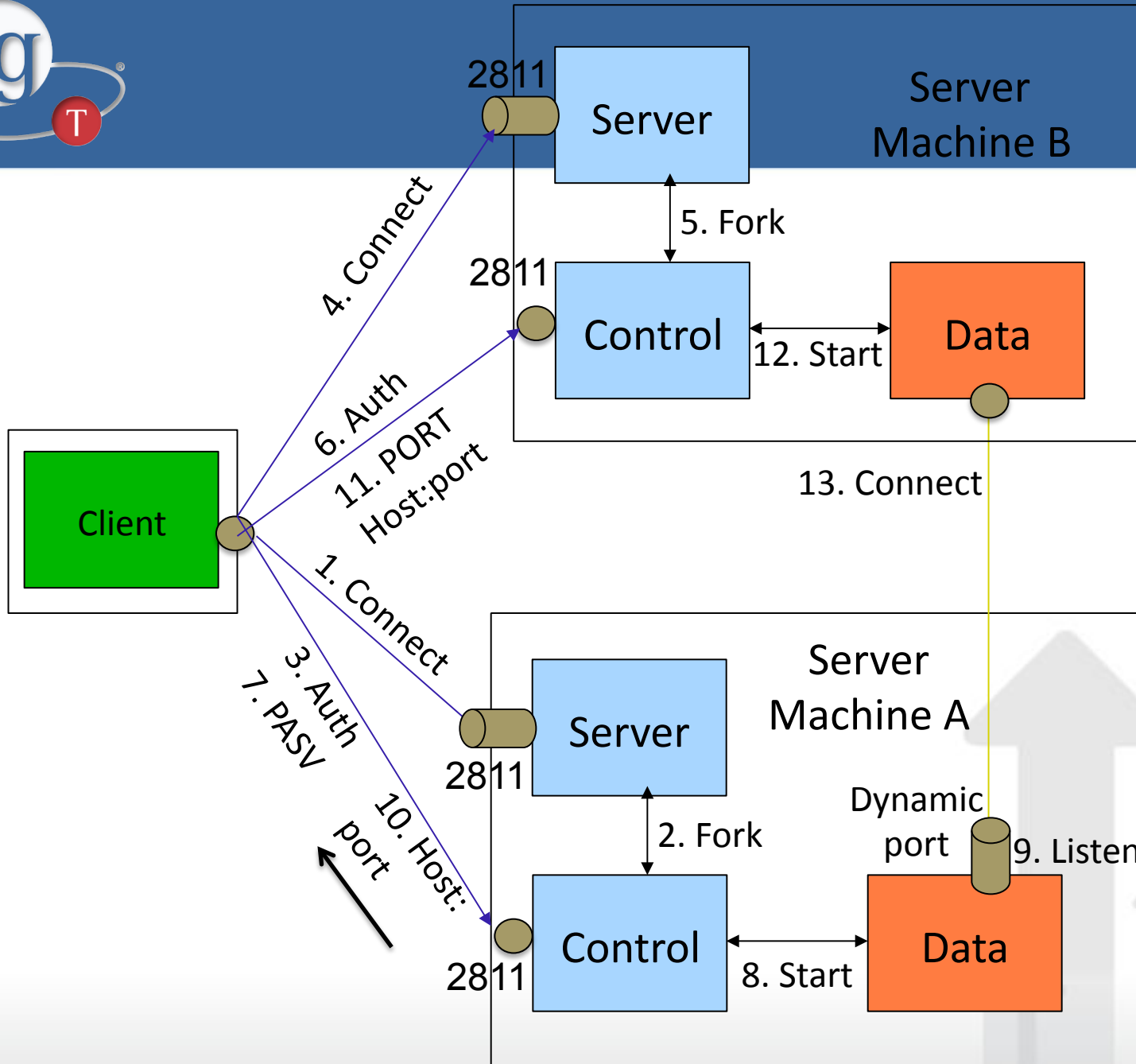1,2013266431,192.168.1.10,54003,host

SITE UPRT
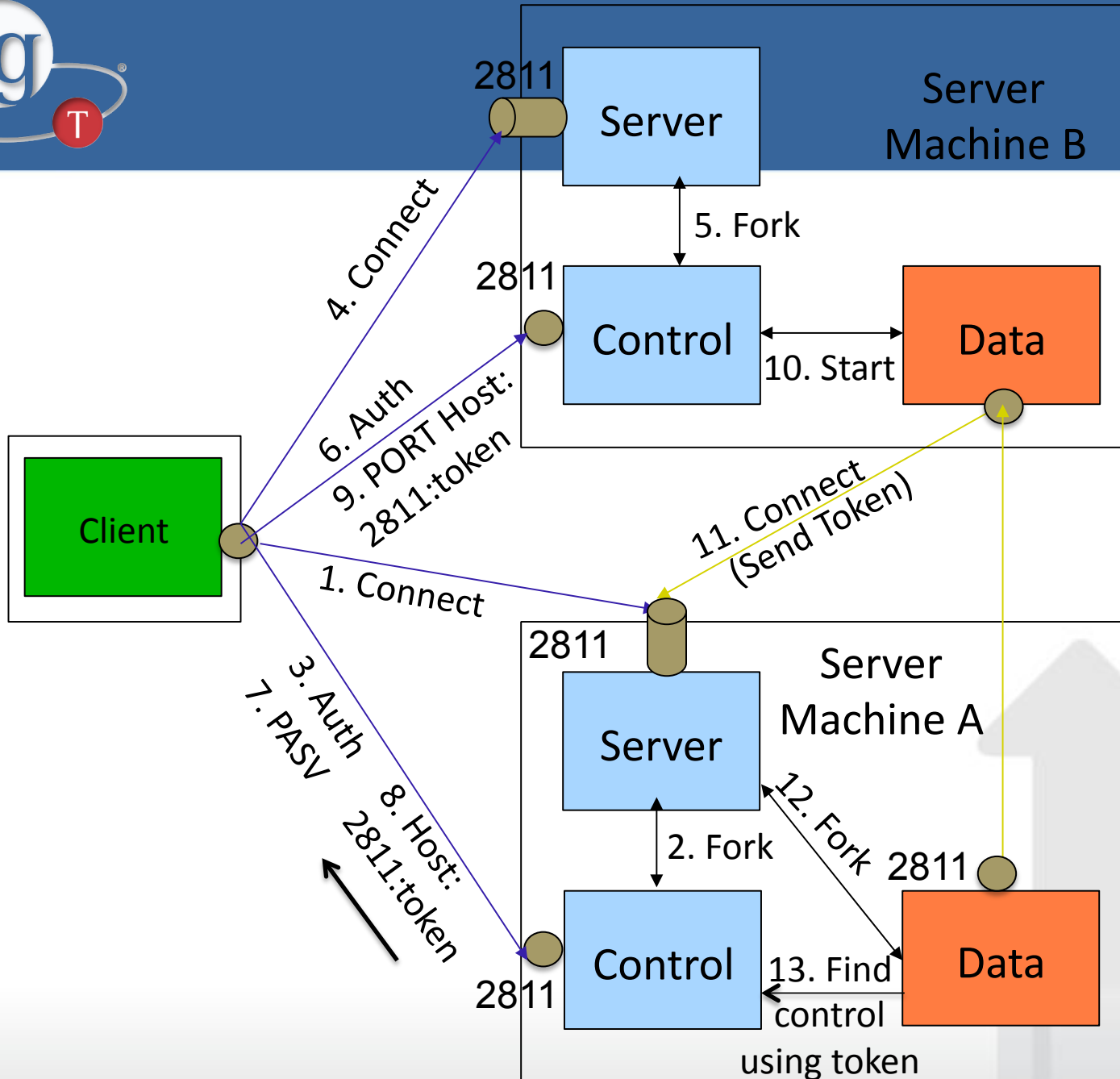tGpe prsJ1JkvZgn60w1PeCgYOX
1,2013266431,10.1.1.128,58646,host

200 OK

PASV

227 Entering Passive Mode
(192.168.1.10,210,243)

[transfer as usual]

www.globustoolkit.org

Globus Toolkit 6.0 release

- **Compatible with GT 5.0 and GT 5.2**
- **Migrate from CVS to Git for version control: https://github.com/globus/globus-toolkit**
- **Simplified build by eliminating GPT and library flavors**
- **Integrate testing into the native package build process**
- **Add binary distribution for windows -- mingw (client only) and cygwin**
- **Add binary package and tarball for Mac OS X**

Support DOE facilities and scientists

- **HPSS 7 integration**
- **Sharing support (with Globus service)**
- **6 releases supporting >15 OS distributions**
- **Many dozens of bug fixes and small enhancements**

File system interactions

- **Knowledge about entire transfer request**
  - Directory transfer
  - List of files

- **Optimize access, improved prefetching**
  - Order of access
  - Block sizes
  - Number of threads

Questions?