New Research Computing functionality provided by NSF-CC*

- **NSF Campus Cyber Infrastructure (CC*) program** – grant awarded for 9/20/21 - 9/2023.

- **Goals of project:**

  - Improve network bandwidth between VIMS and main campus – upgrade from **10 Gigabits per second (Gbps) -> 40 Gbps**
  - Upgrade network to major end-user's offices/labs to 10 Gbps ports
  - Acquire and configure Globus paid subscription to allow sharing of data external collaborators without W&M/VIMS credentials
  - Acquire Data Transfer Node in main-campus HPC for file-transfer in/out of HPC

- **Also (not discussing today):**
  - Stage perfSONAR nodes at various main-campus and VIMS locations for testing of network speeds
  - Science DMZ for main-campus HPC – no more firewalls blocking HPC traffic along path to outside network

All of these have recently been achieved. Grant is complete.
Final report due early next year

NSF-CC*: Special Thanks!

Before we continue, I would like to thank:

Emrys Koenigsmann – VIMS Infrastructure Services Architect
Chris Carpenter – VIMS Infrastructure Services Architect

Norman Elton – W&M Infrastructure Director
Felix Vazquez – W&M Senior Network Engineer
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PIs on grant: Ed Aractingi, Gary Anderson, Joseph Zhang, Kostas Orginos, Me

THANKS FOR ALL OF YOUR HARD WORK!

Upgrade to 40 Gbps between campuses

Before the grant – the connection between VIMS and main-campus was at 10 Gbps
- Fiber between campuses was already in place
- VIMS and W&M networking replaced router boards at both campuses to allow 40 Gbps bandwidth

Figure 1

Main-VIMS campus throughput vs. # 10Gbps host pairs
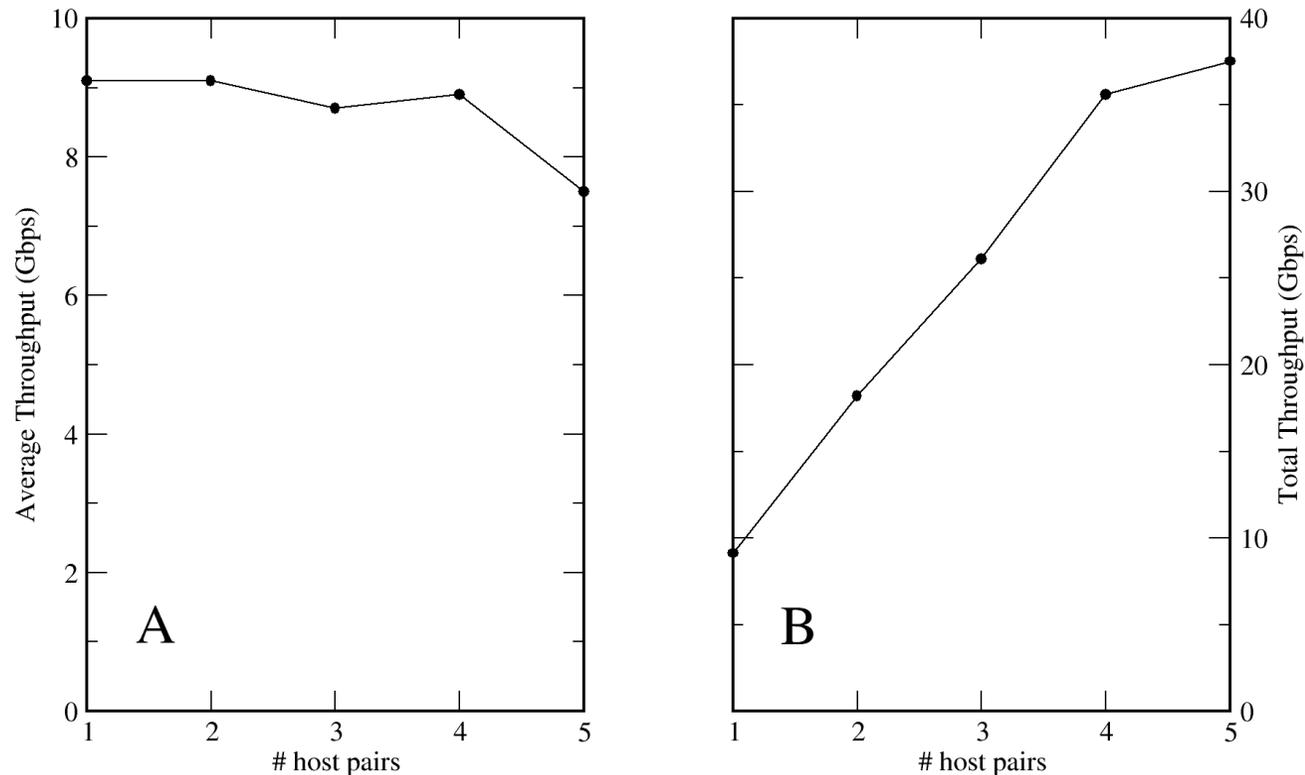
- Host pair is e.g.
  choptank (VIMS)+bora (main)

- Each host pair has 10 Gbps network connections.

- As we increase the number of pairs from 1 to 4, 9 Gbps is achieved for all pairs.

- Once a 5th is added bandwidth starts to decrease.

- 4 x 10Gpbs = 40 Gbps

10 Gbps links

- 10 Gbps network links
  - Within HPC
    - VIMS always had 10 Gbps between HPC front-ends
    - Main campus HPC upgraded all file-servers not already at 10 Gbps

  - To research desktops
    - Some users have already received additional hardware to enable 10 Gbps network to their desktop/laptop.

    - **Achieving file transfer speeds beyond usual 1 Gbps is extremely dependent on desktop/laptop hardware and current network activity. Can your disk supply 10 Gbps data or receive at 10Gbps?**

    - Perhaps the remote site can't perform at 10 Gbps?
    - Multiple users could be pushing data near 10 Gbps over campus backbone ; resulting in contention.

    - Test your connection with iperf3 (https://iperf.fr/iperf-download.php) - can you get 10 Gbps transfer rates with ideal circumstances?   iperf3 will directly test the network bandwidth without involving disk/memory, etc.

Iperf3 Demonstration

```
rc_mac_support@ip-128-239-1-238 ~ % iperf3 -s
-----------------------------------------------------------
Server listening on 5201 (test #1)
-----------------------------------------------------------
Accepted connection from 128.239.56.178, port 46270
[  5] local 128.239.1.238 port 5201 connected to 128.239.56.178 port 46278
[ ID] Interval           Transfer     Bitrate
[  5]   0.00-1.00   sec  1.08 GBytes  9.27 Gbits/sec
[  5]   1.00-2.00   sec  1.09 GBytes  9.37 Gbits/sec
[  5]   2.00-3.00   sec  1.08 GBytes  9.25 Gbits/sec
[  5]   3.00-4.00   sec  1.07 GBytes  9.23 Gbits/sec
[  5]   4.00-5.00   sec  1.08 GBytes  9.30 Gbits/sec
[  5]   5.00-6.00   sec  1.07 GBytes  9.16 Gbits/sec
[  5]   6.00-7.00   sec  1.07 GBytes  9.18 Gbits/sec
[  5]   7.00-8.00   sec  1.06 GBytes  9.13 Gbits/sec
[  5]   8.00-9.00   sec  1.05 GBytes  9.01 Gbits/sec
[  5]   9.00-10.00  sec  1.05 GBytes  9.00 Gbits/sec
[  5]  10.00-10.00  sec   790 KBytes  7.99 Gbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bitrate
[  5]   0.00-10.00  sec  10.7 GBytes  9.19 Gbits/sec       receiver
-----------------------------------------------------------
Server listening on 5201 (test #2)
-----------------------------------------------------------
```

"server" local computer

```
[2 ewalter@io ~ ]$iperf3 -c 128.239.1.238
Connecting to host 128.239.1.238, port 5201
[  5] local 128.239.56.178 port 46278 connected to 128.239.1.238 port 5201
[ ID] Interval           Transfer     Bitrate         Retr  Cwnd
[  5]   0.00-1.00   sec  1.09 GBytes  9.34 Gbits/sec   14   1.20 MBytes
[  5]   1.00-2.00   sec  1.09 GBytes  9.37 Gbits/sec    0   1.76 MBytes
[  5]   2.00-3.00   sec  1.08 GBytes  9.26 Gbits/sec    3   1017 KBytes
[  5]   3.00-4.00   sec  1.07 GBytes  9.23 Gbits/sec    2   1.06 MBytes
[  5]   4.00-5.00   sec  1.08 GBytes  9.30 Gbits/sec    1   1.24 MBytes
[  5]   5.00-6.00   sec  1.07 GBytes  9.15 Gbits/sec    1   1.46 MBytes
[  5]   6.00-7.00   sec  1.07 GBytes  9.19 Gbits/sec   13   1.50 MBytes
[  5]   7.00-8.00   sec  1.06 GBytes  9.13 Gbits/sec   14    884 KBytes
[  5]   8.00-9.00   sec  1.05 GBytes  9.02 Gbits/sec    4    563 KBytes
[  5]   9.00-10.00  sec  1.05 GBytes  9.00 Gbits/sec    2    901 KBytes
- - - - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bitrate         Retr
[  5]   0.00-10.00  sec  10.7 GBytes  9.20 Gbits/sec   54          sender
[  5]   0.00-10.00  sec  10.7 GBytes  9.19 Gbits/sec              receiver

iperf Done.
[3 ewalter@io ~ ]$
```

"client" remote computer

- Start server on your local computer: `iperf3 -s`
- Next, start client on remote computer: `iperf3 -c <host/IP>`
- Look for "Bitrate" - example shows ~9.3 Gbps ~ 1.2 GB/s

Use https://www.whatismyip.com/ if you can't find your IP address

Best practices file transfers to maximize bandwidth

1

Choose most direct path

Especially for scp/sftp transfers to/from HPC systems, see:

https://www.wm.edu/offices/it/services/researchcomputing/using/xfers/

For guide to which location is home to which fileserver.
Using incorrect path causes excess NFS traffic on front-ends

Good – 1 hop
Bad – 2 hops
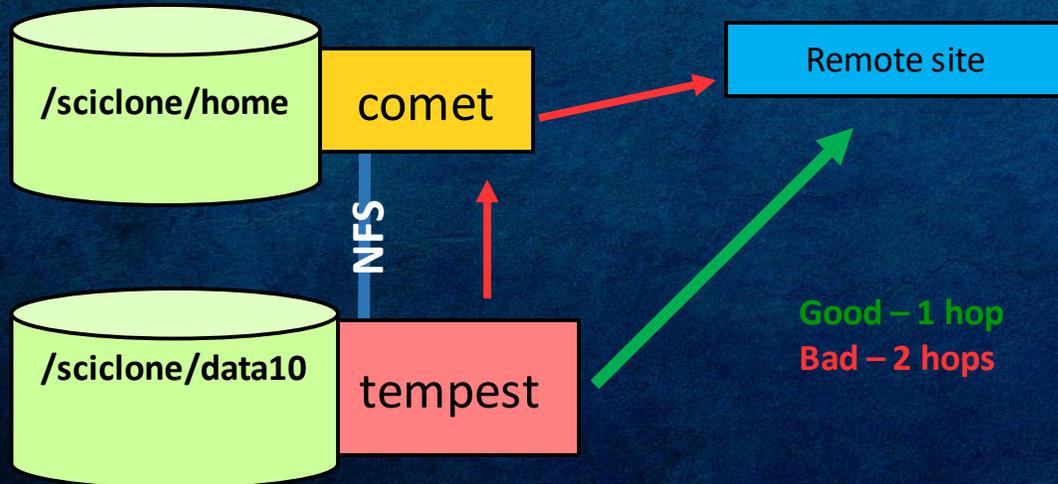
Filesystem	Recommended node and Endpoint Display Name
/sciclone/* (New endpoint to be used for all sciclone transfers once Globus V4 is deprecated)	io.sciclone.wm.edu W&M RC/HPC/IO Collection
/sciclone/home	comet.sciclone.wm.edu Sciclone Cluster at W&M, home (Comet)
/sciclone/pscr	bora.sciclone.wm.edu Sciclone Cluster at W&M, pscr (Bora)
/sciclone/data10	tempest.sciclone.wm.edu Sciclone Cluster at W&M, data10 (Tempest)
/sciclone/scr10	polar.sciclone.wm.edu Sciclone Cluster at W&M, scr10 (Polar)
/ches/home00	james.hpc.vims.edu VIMS Cluster at W&M, home00 (James)
/ches/data10	choptank.hpc.vims.edu VIMS Cluster at W&M, data10 (Choptank)
/ches/scr10	rappahannock.hpc.vims.edu VIMS Cluster at W&M, scr10 (Rappahannock)

Globus changes DTN and new features

2

Use Globus wherever possible

- Until recently, Globus v4 on main-campus and VIMS HPC
- New, Globus v5 login occurs before any collection/endpoint is selected
- **Guest collections only work for Globus v5**
- Main Campus: Data transfer node (DTN): io.sciclone.wm.edu
    - Used to stage guest collection data for obtaining without a W&M account
    - Preferred path for sharing data is io:/data/<user>
    - Will continue to run server specific Globus v4 until EOL

- VIMS: Globus v5 also installed on james now and will be on choptank and rappahannock
    No dedicated IO node so want connections to be direct to server with data.

- Globus will typically beat SCP by ~2x speed (60-70% of bandwidth)
- https://www.wm.edu/offices/it/services/researchcomputing/using/xfers/globus/clusters/

- **NOTE for Globus v5**, W&M login by default must match HPC login. We have manually inserted rules to change W&M login to HPC login where necessary.   Please contact hpc-help@wm.edu if this is not working

Demonstrate Globus v4 vs. Globus v5

Globus Guest Collection

Guest Collections

- Globus guest collection can be created on any Globus endpoint with **v5**
- Main-campus – io.sciclone.wm.edu
- VIMS – currently just james (upgrades to chop, rapp coming)

- Guest collection gives access to anyone with a GlobusID and any email can be tied to GlobusID
- GlobusID can be created when logging in and tied to an email address

- See: https://www.wm.edu/offices/it/services/researchcomputing/using/xfers/globus/guest/
  For more information

Demonstrate Guest Collection on Globus v5

Globus Connect Personal

Globus Connect Personal

- Can connect your local computer to Globus collections / endpoints
- Available for Windows, Mac and Linux
- Useful for GUI interface to Globus collections / endpoints

- Get it from https://www.globus.org/globus-connect-personal
- Download for appropriate client (Windows, Mac, or Linux)
- Follow steps on: https://www.wm.edu/offices/it/services/researchcomputing/using/xfers/globus/personal/

Demonstrate Guest Connect Personal

Conclusion

We are just starting to learn how to reap the full benefits of faster networking and Globus subscription benefits.
Please consider testing of your connection bandwidth with iperf3 before looking into other hardware problems

Please see new online documentation:
https://www.wm.edu/offices/it/services/researchcomputing/using/xfers for info on globus and other file transfer program guides

Consider using Globus whenever possible

Contact hpc-help@wm.edu for help with Globus and file transfers

Thank you