GACRC

Introduction to GACRC Storage Environment

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Outline

- What is GACRC?
- Overview of Linux Commands
- GACRC Storage Environment
- Data Transferring
- Snapshot and Backup
- Best Practice Suggestions from GACRC

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What is GACRC?

Who Are We?

- **G**eorgia **A**dvanced **C**omputing **R**esource **C**enter
- Collaboration between the Office of Vice President for Research (**OVPR**) and the Office of the Vice President for Information Technology (**OVPIT**)
- Guided by a faculty advisory committee (GACRC-AC)

Why Are We Here?

- To provide computing hardware and network infrastructure in support of high-performance computing (**HPC**) at UGA

Where Are We?

- http://gacrc.uga.edu (Web)
- http://wiki.gacrc.uga.edu (Wiki)
- http://gacrc.uga.edu/help/ (Web Help)
- https://wiki.gacrc.uga.edu/wiki/Getting_Help (Wiki Help)

GACRC Users September 2015

Colleges & Schools	Depts	PIs	Users
Franklin College of Arts and Sciences	14	117	661
College of Agricultural & Environmental Sciences	9	29	128
College of Engineering	1	12	33
School of Forestry & Natural Resources	1	12	31
College of Veterinary Medicine	4	12	29
College of Public Health	2	8	28
College of Education	2	5	20
Terry College of Business	3	5	10
School of Ecology	1	8	22
School of Public and International Affairs	1	3	3
College of Pharmacy	2	3	5
	40	214	970
Centers & Institutes	9	19	59
TOTALS:	49	233	1029

GACRC Users September 2015

Centers & Institutes	PIs	Users
Center for Applied Isotope Study	1	1
Center for Computational Quantum Chemistry	3	10
Complex Carbohydrate Research Center	6	28
Georgia Genomics Facility	1	5
Institute of Bioinformatics	1	1
Savannah River Ecology Laboratory	3	9
Skidaway Institute of Oceanography	2	2
Center for Family Research	1	1
Carl Vinson Institute of Government	1	2
	19	**59**

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Overview of Linux Commands

- Folder Navigating
- File Copying and Moving
- File Compression and Packaging
- Disk Storage and Filesystem

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Overview of Useful Linux Commands

- Folder Navigating

  `pwd`: Print the absolute path of your current directory : `pwd`

  `cd`: Change current directory : `cd ..`, `cd /`, `cd /home/yourHome`

- File Copying and Moving

  `cp`: Copy files : `cp file1 file2`, `cp file1 ./subDir`

  `mv`: Rename or move files : `mv file1 file2`,

  `mv file1 file2 ./subDir`

Overview of Useful Linux Commands

- File Compression and Packaging

  `gzip`: Compress files with GNU Zip

  `gzip file` ➔ Compress *file* to create *file.gz*. Original *file* is deleted

  `gunzip`: Uncompress GNU Zip files

  `gunzip file.gz` ➔ Uncompress *file.gz* to create *file*. Original *file.gz* is deleted.

Overview of Useful Linux Commands

- File Compression and Packaging

  `tar`: Pack multiple files and directories into a single file for *transport*, optionally *compressed*

`tar -cvf myarchive.tar ./myDir`	➔ Create package
`tar -tvf myarchive.tar`	➔ List contents
`tar -xvf myarchive.tar`	➔ Extract package
`tar -czvf myarchive.tar.gz ./myDir`	➔ Create & Compress
`tar -tzvf myarchive.tar.gz`	➔ List contents
`tar -xzvf myarchive.tar.gz`	➔ Uncompress & Extract

Overview of Useful Linux Commands

- Disk Storage and Filesystem

  `ls`: List the contents (files and subdirectories) of a directory

  `ls -l` ➔ Long listing including file attributes

  `ls -h` ➔Print file sizes in KB, MB, and GB, instead of bytes

  `ls -a` ➔ List all files, including hidden files whose names begin with a dot

  `du`: Measure the disk space occupied by files and directories

  `du -h` ➔ Measure the size of current directory and all its subdirectories

  `du -h file1 file2` ➔ Measure the size of two files

Overview of Useful Linux Commands

- Disk Storage and Filesystem

  `df`: Report on all mounted filesystems with the size, used space, and free space

  `df -h` ➔ Print human-readable output, and choose the most appropriate unit for each size

Filesystem	Size	Used	Avail	Use%	Mounted on
/dev/mapper/VolGroup01-LogVol_root	99G	14G	84G	15%	/
devtmpfs	16G	0	16G	0%	/dev
tmpfs	16G	2.4M	16G	1%	/run
/dev/sda1	486M	59M	402M	13%	/boot
/dev/mapper/VolGroup01-LogVol_home	493G	86G	406G	18%	/home

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GACRC Storage Environment

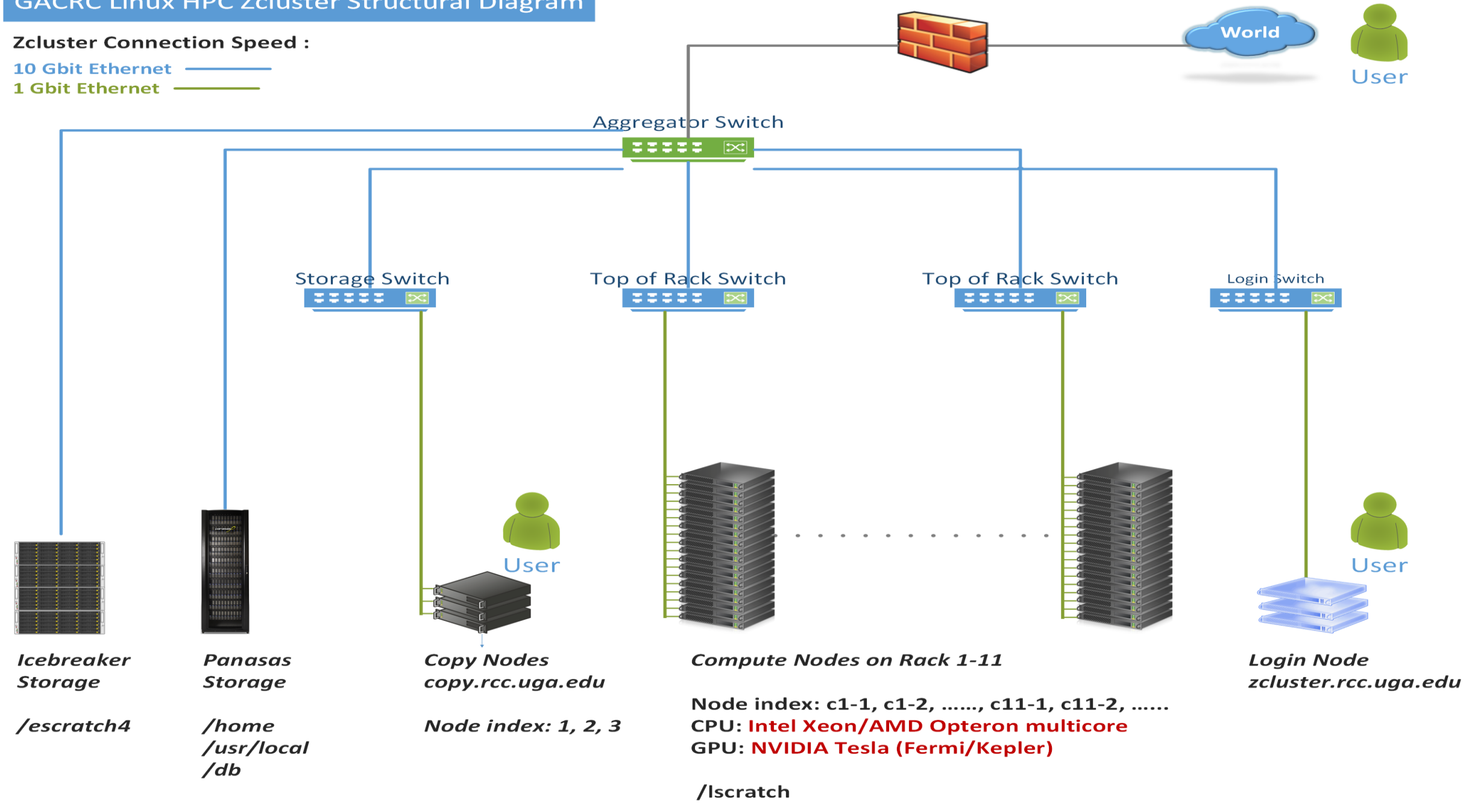
- zcluster Storage Environment
- Sapelo Storage Environment
- GACRC Storage Environment

GACRC Linux HPC Zcluster Structural Diagram

Zcluster Connection Speed :

10 Gbit Ethernet

1 Gbit Ethernet



Icebreaker Storage

/escratch4

Panasas Storage

/home
/usr/local
/db

Copy Nodes
copy.rcc.uga.edu

Node index: 1, 2, 3

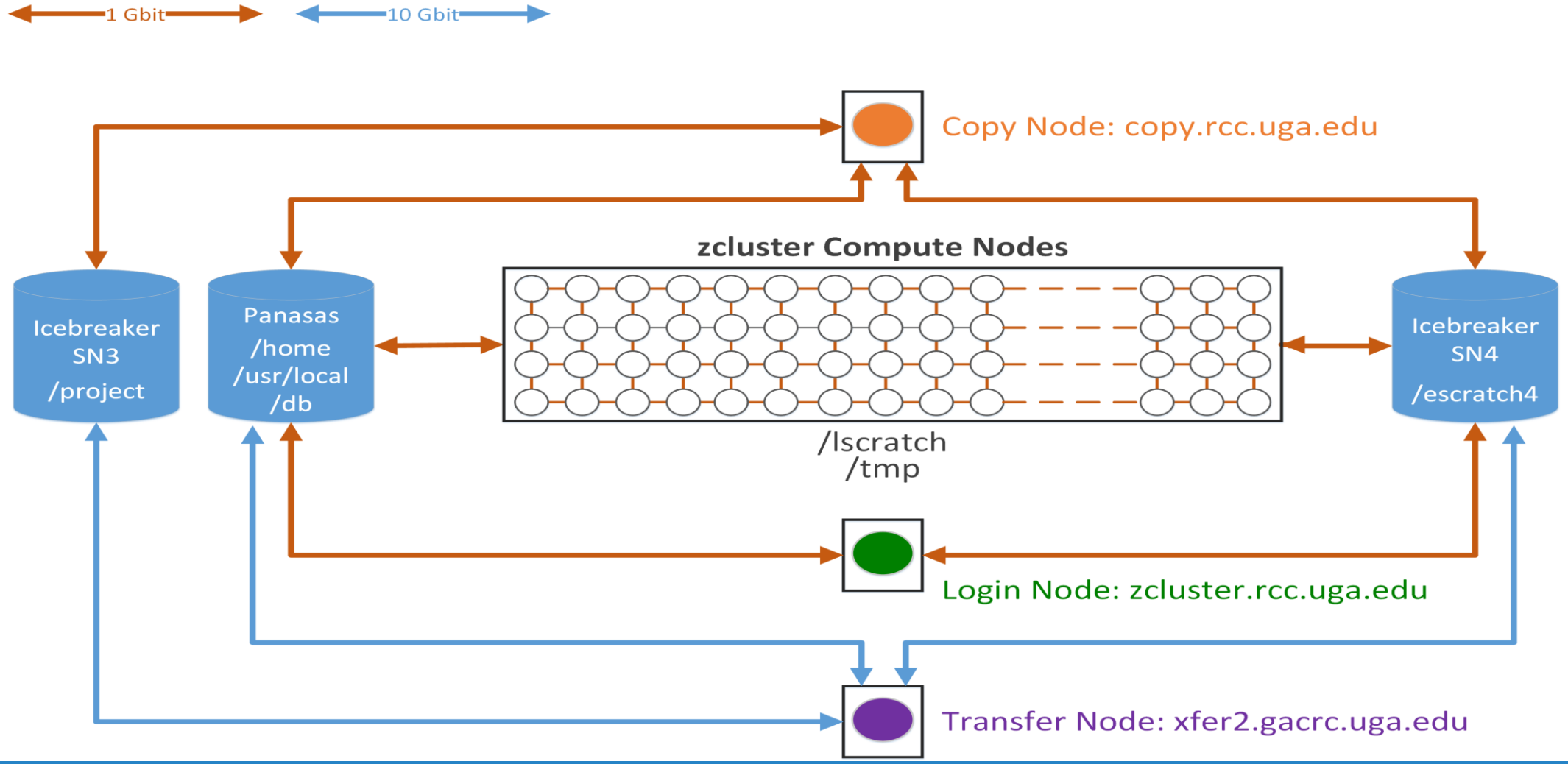
Compute Nodes on Rack 1-11

Node index: c1-1, c1-2, ……, c11-1, c11-2, ……
CPU: Intel Xeon/AMD Opteron multicore
GPU: NVIDIA Tesla (Fermi/Kepler)

/lscratch

Login Node
zcluster.rcc.uga.edu

zcluster Storage Environment



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zcluster Storage Environment

Filesystem	Role	Quota	Accessible from	Intended Use	Notes
/home/abclab/username	Home	100GB	zcluster.rcc.uga.edu (Login) Interactive nodes (Interactive) copy.rcc.uga.edu (Copy) xfer2.gacrc.uga.edu (Transfer) compute nodes (Compute)	Highly static data being used frequently	Snapshots
/escratch4/username	Scratch	4TB		Temporarily storing large data being used by jobs	Auto-deleted in 37 days
/lscratch/username	Local Scratch	18 ~ 370GB	Individual compute node	Jobs with heavy disk I/O	User to clean up
/project/abclab	Storage	Variable	copy.rcc.uga.edu (Copy) xfer2.gacrc.uga.edu (Transfer)	Long-term data storage	Group sharing possible

Note: 1. /usr/local : Software installation directory
/db : bioinformatics database installation directory
2. To login to Interactive nodes, use `qlogin` from Login node

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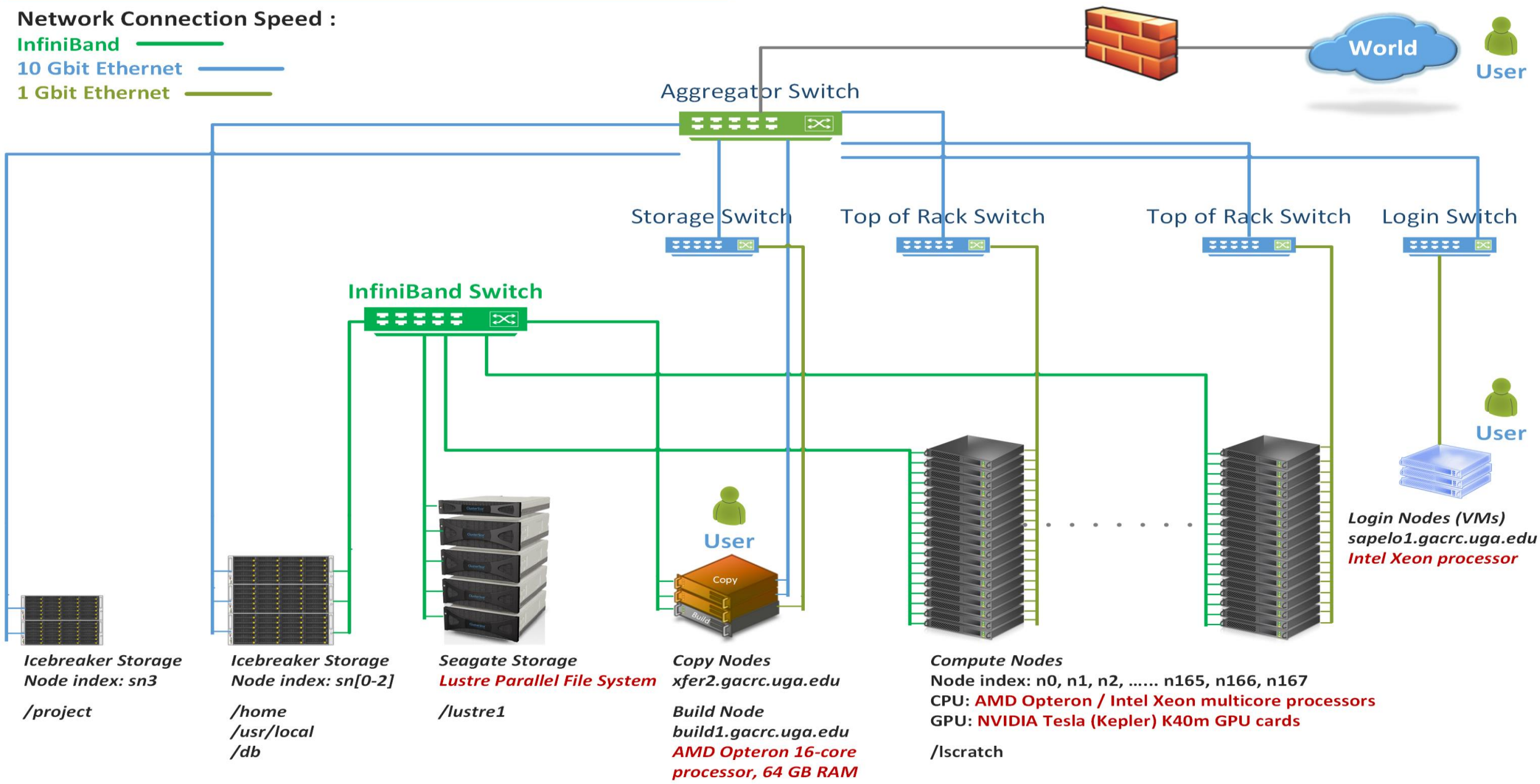
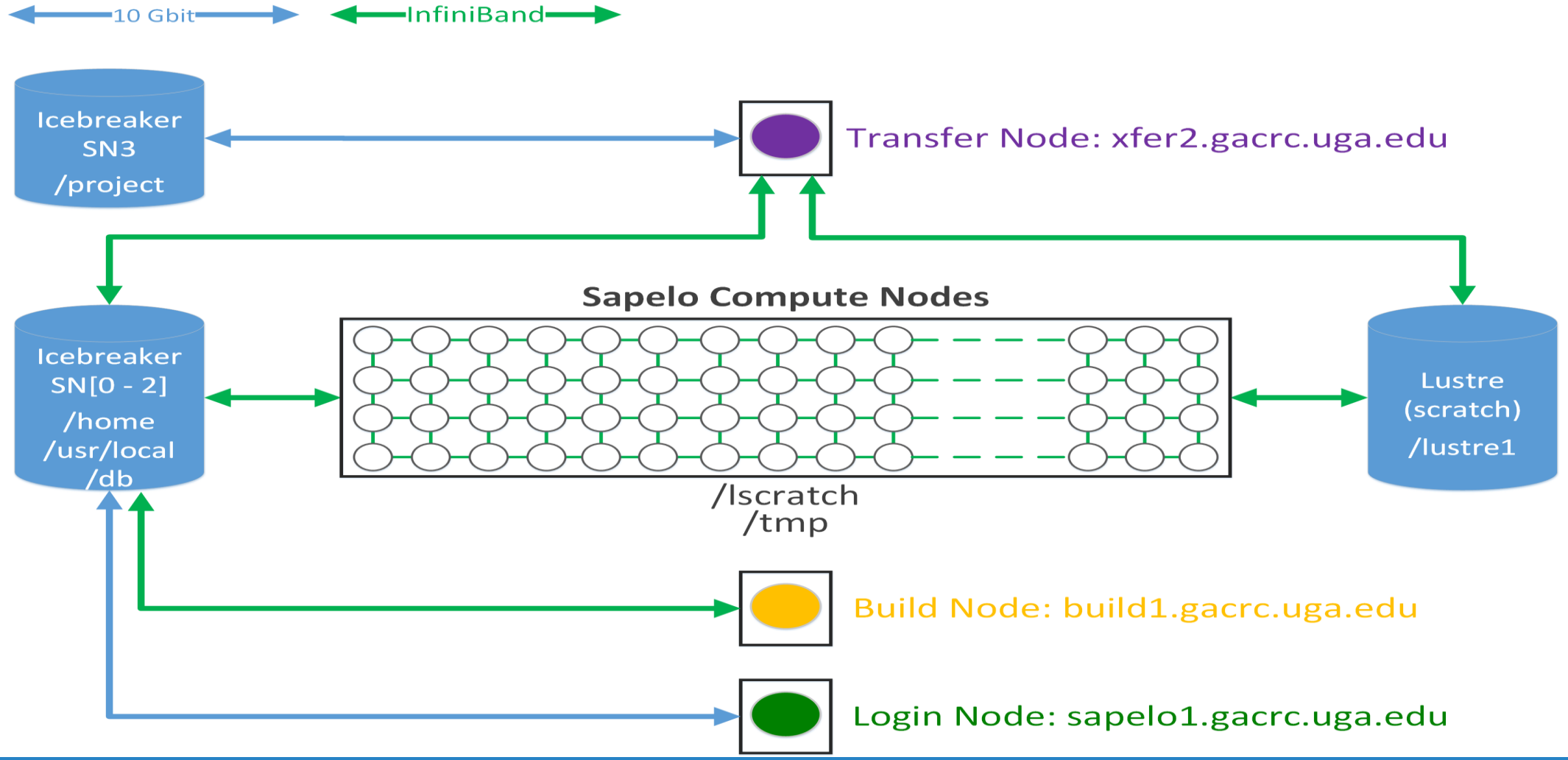
zcluster Storage Environment

6 Main Function	On/From-Node	Related Filesystem
Login Landing	Login or Copy	/home/abclab/username (Home) (Always!)
Batch Job Submitting	Login or Interactive	/escratch4/username (Scratch) (Suggested!) /home/abclab/username (Home)
Interactive Job Running	Interactive	/escratch4/username (Scratch) /home/abclab/username (Home)
Data Archiving , Compressing and Transferring	Copy or Transfer	/escratch4/username (Scratch) /home/abclab/username (Home)
Job Data Temporarily Storing	Compute	/lscratch/username (Local Scratch) /escratch4/username (Scratch)
Long-term Data Storing	Copy or Transfer	/project/abclab

The New GACRC Linux HPC Cluster Structural Diagram



Sapelo Storage Environment



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Sapelo Storage Environment

Filesystem	Role	Quota	Accessible from	Intended Use	Notes
/home/username	Home	100GB	sapelo1.gacrc.uga.edu (Login) Interactive nodes (Interactive) xfer2.gacrc.uga.edu (Transfer) build1.gacrc.uga.edu (Build) compute nodes (Compute)	Highly static data being used frequently	Snapshots
/lustre1/username	Scratch	No Limit	Interactive nodes (Interactive) xfer2.gacrc.uga.edu (Transfer) compute nodes (Compute)	Temporarily storing large data being used by jobs	Auto-moved to /project if 30 days no modification
/lscratch/username	Local Scratch	250GB	Individual compute node	Jobs with heavy disk I/O	User to clean up
/project/abclab	Storage	Variable	xfer2.gacrc.uga.edu (Transfer)	Long-term data storage	Group sharing possible

Note: 1. /usr/local/apps : Software installation directory
/db : bioinformatics database installation directory
2. To login to Interactive nodes, use `qlogin` from Login node

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Sapelo Storage Environment

7 Main Functions	On/From-Node	Related Filesystem
Login Landing	Login or Transfer or Build	/home/username (Home) (Always!)
Batch Job Submitting	Login	/home/username (Home)
	Interactive	/lustre1/username (Scratch) (Suggested!) /home/username (Home)
Interactive Job Running	Interactive	/lustre1/username (Scratch) /home/username (Home)
Data Archiving , Compressing and Transferring	Transfer	/lustre1/username (Scratch) /home/username (Home)
Job Data Temporarily Storing	Compute	/lscratch/username (Local Scratch) /lustre1/username (Scratch)
Long-term Data Storing	Copy or Transfer	/project/abclab
Code Compilation	Build	/home/username (Home)

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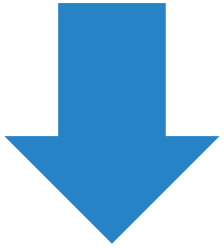
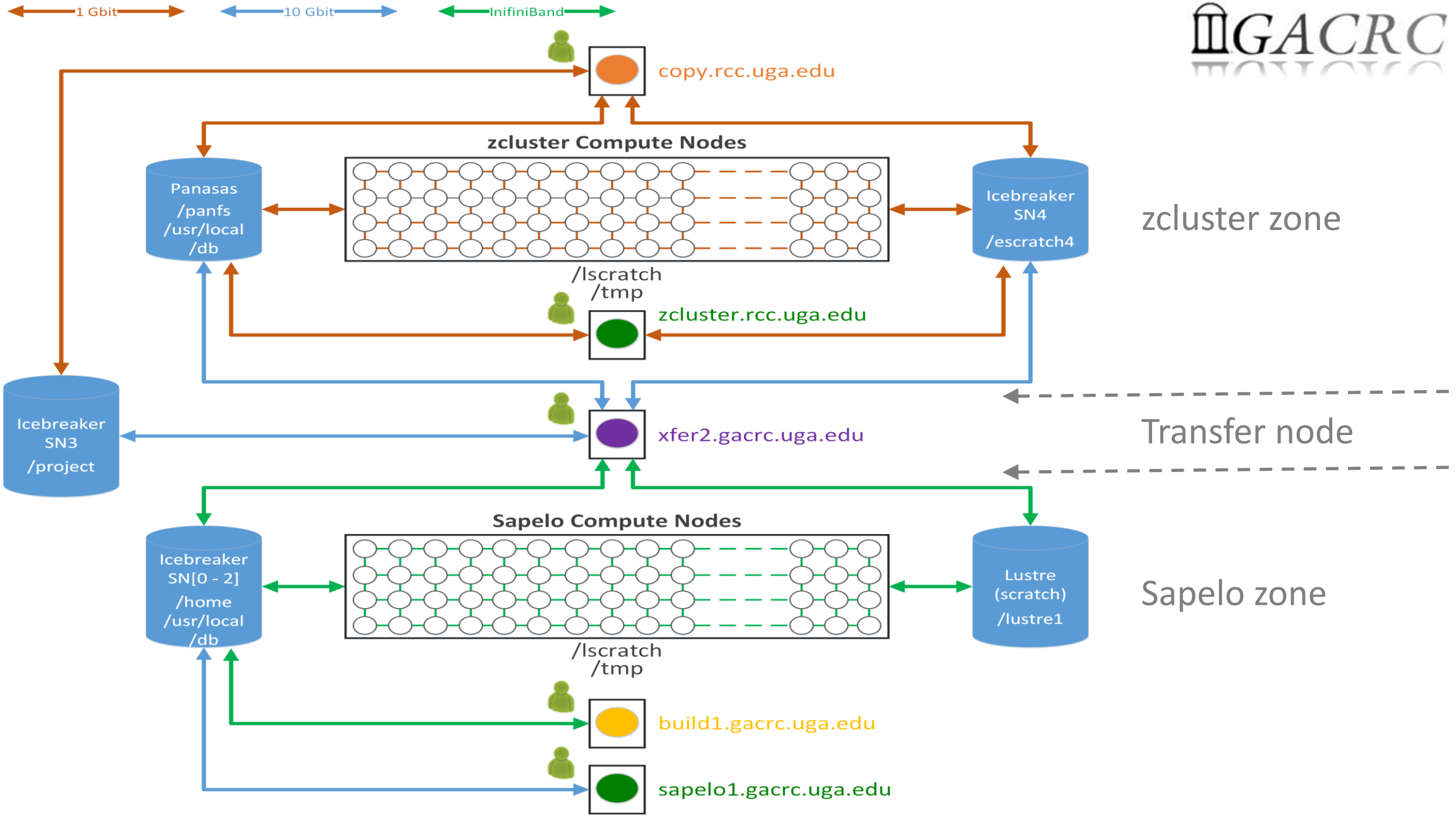
GACRC Storage Environment

Next Page




1 Gbit
10 Gbit
InifiniBand
copy.rcc.uga.edu
zcluster Compute Nodes
Panasas
/panfs
/usr/local
/db
Icebreaker
SN4
/escratch4
/lscratch
/tmp
zcluster.rcc.uga.edu
zcluster zone
Icebreaker
SN3
/project
xfer2.gacrc.uga.edu
Transfer node
Sapelo Compute Nodes
Icebreaker
SN[0 - 2]
/home
/usr/local
/db
Lustre
(scratch)
/lustre1
/lscratch
/tmp
Sapelo zone
build1.gacrc.uga.edu
sapelo1.gacrc.uga.edu

GACRC Storage Environment

What you should know about xfer2 (xfer2.gacrc.uga.edu):

- ✓ Transfer node b/w zcluster and Sapelo + Copy node of Sapelo
- ✓ Home directory on xfer2 = Home directory on Login of Sapelo : `/home/username`
- ✓ File systems on xfer2:
  - /home/username : Sapelo home
  - /panfs/pstor.storage/home/abclab/username : zcluster home
  - /lustre1/username : Sapelo scratch
  - /escratch4/username : zcluster scratch
  - /project/abclab : long-term archival storage
- ✓ Most file systems on xfer2 are ***auto-mounted*** upon ***the first time full-path access***, e.g., `cd /lustre1/username`. The command `ls` and `TAB` auto-completion may not work if the file system has not been mounted.

GACRC Storage Environment

What you should know about Copy (copy.zcluster.rcc.uga.edu):

- ✓ Copy node of zcluster
- ✓ Home directory on Copy = Home directory on Login of zcluster : `/home/abclab/username`
- ✓ File systems on Copy:
  - /home/abclab/username : zcluster home
  - /escratch4/username : zcluster scratch
  - /project/abclab : long-term archival storage
- ✓ /project file system on Copy is ***auto-mounted*** upon ***the first time full-path access***, e.g., `cd /project/abclab/username`. The command `ls` and `TAB` auto-completion may not work if the file system has not been mounted.

Data Transferring

- b/w two filesystems on zcluster
- b/w two filesystems on Sapelo
- b/w local and GACRC Storage
- b/w GACRC zcluster and Sapelo
- b/w Internet and GACRC Storage
- Refer to https://wiki.gacrc.uga.edu/wiki/Transferring_Files

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Data Transferring b/w two filesystems on zcluster

- Transfer interactively:
  - ✓ Login to Copy
  - ✓ Use `cd` to change directory
  - ✓ Use `cp` or `mv` to copy or move data

- Transfer by copy queue:
  - ✓ Create copying job submission script: `copy.sh`, e.g.:

```
#!/bin/bash
cd ${HOME}
cp -r dataDir /project/abclab/username
```

  - ✓ Submit to copyq: `qsub -q copyq copy.sh`

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Data Transferring b/w two filesystems on Sapelo

- /lustre1 scratch is visible on xfer2 or Interactive, NOT on Login!
- Transfer interactively on xfer2:
  - ✓ Login to xfer2
  - ✓ Use `cd` to change directory
  - ✓ Use `cp` or `mv` to copy or move data

Data Transferring b/w local and GACRC Storage

- zcluster users:
  - ✓ Use Copy
  - ✓ Linux/Mac OS X machine: `scp`, `sftp`, or *FileZilla*
  - ✓ Windows machine: *SSH file Transfer*, *FileZilla*, or *WinSCP*

- Sapelo users:
  - ✓ Use xfer2
  - ✓ Linux/Mac OS X machine: `scp`, `sftp`, or *FileZilla*
  - ✓ Windows machine: *SSH file Transfer*, *FileZilla*, or *WinSCP*

Data Transferring b/w GACRC zcluster and Sapelo

- All users having zcluster and Sapelo accounts:
  - ✓ Login to xfer2
  - ✓ Filesystems on xfer2:
    - /home/username : Sapelo home
    - /panfs/pstor.storage/home/abclab/username : zcluster home
    - /lustre1/username : Sapelo scratch
    - /escratch4/username : zcluster scratch
    - /project/abclab : long-term archival storage
  - ✓ Use `cd` to change directory
  - ✓ Use `cp` or `mv` to copy or move data

Data Transferring b/w Internet and GACRC Storage

- zcluster users: Login to Copy (copy.rcc.uga.edu)
- Sapelo users: Login to xfer2 (xfer2.gacrc.uga.edu)
- Use command `wget` or `curl` to download software from internet, e.g.,

```
wget http://www.ebi.ac.uk/ena/data/view/SRR1183952

Curl -OL http://www.ebi.ac.uk/ena/data/view/SRR1183952
```

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Snapshot

- Only homes on zcluster and Sapelo are snapshotted!

  *Note: home is for **highly static** data being used frequently*

- Snapshots are completely invisible, read-only, and moment-in-time.
- 4 daily ones and 1 weekly one are maintained.
- Snapshots are ***eating up*** your Sapelo home 100GB, if there are frequent data modifications in home.

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Backup

- Backup environment has not been implemented by GACRC yet.
- In the future, file systems to be included in GACRC Backup:

  Zcluster /home

  Sapelo /home

  Sapelo /project

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Best Practice Suggestions from GACRC

1. From **scratch** (Sapelo /lustre1 or zcluster /esratch4), instead of from home, to submit your batch jobs or run your interactive jobs!

   Question: How to submit batch jobs from scratch?

   1) From Sapelo /lustre1:

   Method 1: Login to Interactive (`qlogin`) ➔ `cd /lustre1/username` ➔ submit job

   Method 2: Login to Login ➔ Put `cd /lustre1/username` in job submission script ➔ submit job

   2) From zcluster /escratch4:

   Method 1: Login to Login ➔ `cd /escratch4/username` ➔ submit job

   Method 2: Login to Interactive (`qlogin`) ➔ `cd /escratch4/username` ➔ submit job

Best Practice Suggestions from GACRC

2. Clean Up Files that are not needed from scratch
3. Move Files from scratch to /project for long-term storage
4. Compress Files, especially text files in /project, to save space

Please Do NOT Park Your Data in Scratch!

Otherwise, whole system scratching performance will be affected, and your and others' job will be affected!

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Thank You!