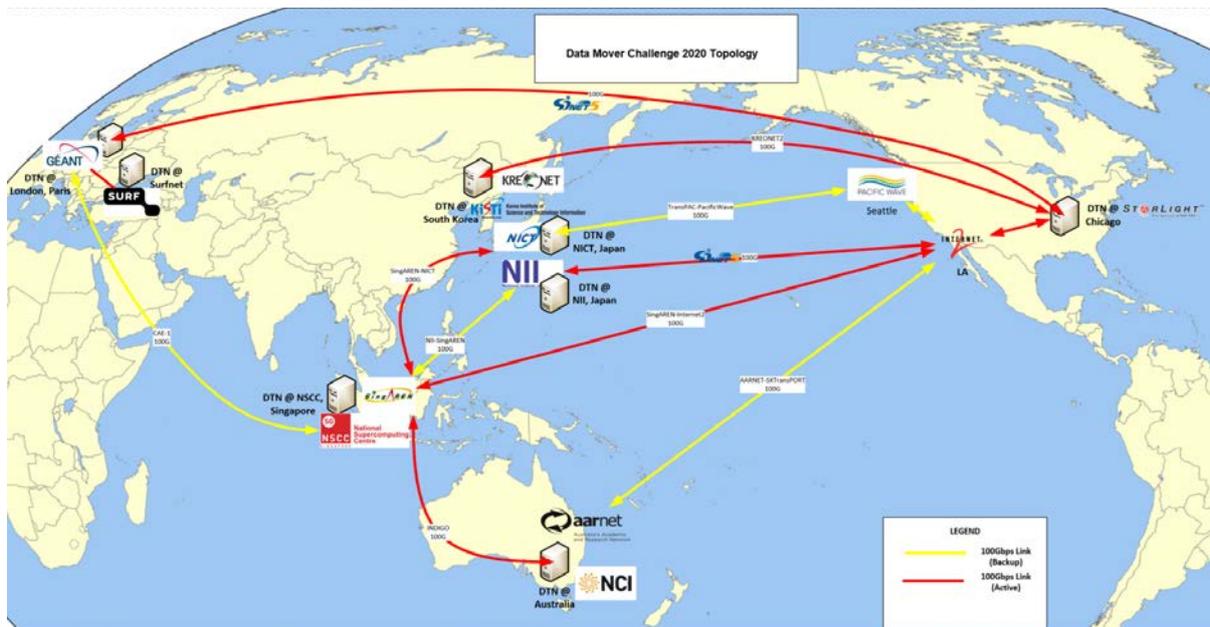


**SCA20 Data Mover Challenge
(Participants' Information)**

1. Network Topology



2. DTN server set up at each Partner site

2.1. IP reachability to NSCC DTN over the global 100G networks (10.250.11.x/24)

Device	Hostname	100G Interface (VLAN1312)
DTN @ NSCC	nsc01	10.250.11.21
DTN @ NCI	nci01	10.250.11.31
DTN @ GEANT (London / Paris)	geant01, 02	10.250.11.41, 42
DTN @ StarLight	starlight01	10.250.11.51
DTN @ KISTI	ksiti01	10.250.11.61
DTN @ NICT	nict01	10.250.11.71
DTN @ NII	nii01	10.250.11.81
DTN @ Surfnet	surfnet01	10.250.11.91

2.2. Operating System and Software to be set up on each DTN

- Centos7.5
- Iperf3
- Singularity v3.2
- squashfs-tools

- 2.3. DTN tuning and scripts run
- OS /etc/sysctl.conf parameter values tuning has been configured (refer to [Annex B](#): DTN servers sysctl tuning guide)
 - 100G Interfaces has been tuned (refer to [Annex C](#): 100G interface tuning script)
 - Disk FIO script has been run and collected. (refer to [Annex D](#): Disk FIO script)
 - lshw command output collected. (refer to [Annex E](#): lshw command)
- 2.4. Commercial Internet out of band (OOB) SSH Access will be provided at NSCC DTN (nsc01) for participants' access into the DMC DTN network.
- Participants to provide public IP address they will login from to be added to the SSH access list.
 - From nsc01 DTN, participants can access the other DTNs via ssh from the 100G vlan 1312 interface.
- 2.5. Participants will SSH into NSCC DTN to an account with non-root access
- Login account and password will be provided before the challenge scheduled date.
 - Limited root and BIOS access to the DTNs by request only to be implemented by local partner system administrator subject to approval from DMC committee.
- 2.6. A /DMC directory has been created on each DTN with the following subdir:
- test - a READ/WRITE directory as the destination the data set transfer
 - data - a READONLY directory as the source of the data set
- 2.7. Host file set up for the DTNs
- ```
cat /etc/hosts
10.250.11.21 nsc01
10.250.11.31 nci01
10.250.11.41 geant01
10.250.11.42 geant02
10.250.11.51 starlight01
10.250.11.61 kisti01
10.250.11.71 nict01
10.250.11.81 nii01
10.250.11.91 surfnet01
```
- 2.8. 10.250.11.x interface has been added to firewall trusted zone to allow all traffic between inter-DTN facing network

### 3. The Data Mover Challenge

The Data Mover Challenge will run from Aug 2019 to Jan 2020 (excluding Oct and Nov 2019).

Each Participating Team will be given 5 days for the challenge.

**Monday SGT (UTC+8) 0000Hrs – Wednesday SGT (UTC+8) 2359Hrs: Software Setup**

**Thursday SGT (UTC+8) 0000Hrs – Friday SGT (UTC+8) 2359Hrs: Running and demonstrating of Software to judges (Statistics and results will be captured)**

The winning team's leader will be invited to attend **SupercomputingAsia 2020 (SCA20) from 24-27 Feb 2020 in Singapore** for an award presentation and solution showcase.

### 4. Scope of DTN Data Transfer tests

2TB data set consisting of Genome and Satellite mixed data type and sizes

2-way Data Transfer scenarios **(the below test are tentative and are to be confirmed)**

1. nsc01 <-> nci01 (via Indigo)
2. nsc01 <-> starlight01 (via SingAREN-I2)
3. nsc01 <-> nict01 (via SingAREN-NICT)
4. nii01 <-> surfnet01, geant01/02 (via SINET-US-SINET-Europe)
5. nci01 <-> kisti01 (via Indigo-SingAREN-I2-StarLight-KREONET)

The data set will be copied from the NSCC DTN to the local storage on each remote DTN and then back to NSCC DTN

A /DMC directory has been created with the following subdir:

- test - a READ/WRITE directory as the destination the data set transfer
- data - a READONLY directory as the source of the data set

### 5. Judging Criteria

1. Error free data transfer performance (average transfer rate and time taken) of the data set
  - Memory to Memory Test for both directions **(Weightage 20%)**
  - Disk to Disk Test for both directions **(Weightage 40%)**
2. Technological Innovation base on solution submission and interview with judges **(Weightage 20%)**
3. End-user Experience including user interface, ease of installation, licensing model, and integration with services such as access federation etc. **(Weightage 20%)**

### 6. Participants Rules and Conditions

- 6.1. Participants will be required to provide the public ip address they will be using to access NSCC DTN via SSH.
  - Once logged into NSCC DTN, participants will be able to access the other DTNs thru the private VLANs set up as shown in the global 100G network topology diagram and table above.
  - Participant will log in with non-root access account. Competing Teams will only deploy their data transfer tools and software on Singularity Containers running on the DTNs.
  - Please refer to <https://sylabs.io/guides/3.2/user-guide.pdf> for the Singularity Container User Guide Documentation
  - Also Refer to Annex F: Example Singularity Recipes to build Containers
- 6.2. BIOS and administrative/root level access to the DTNs will be limited and by request basis only. Changes will be implemented by local partner system administrator only, subject to DMC committee approval.

- 6.3. Competing Teams will have 5 days to deploy and run data transfer tests based on given scenarios
- 3 days to set up software  
**Monday SGT (UTC+8) 0000Hrs – Wednesday SGT (UTC+8) 2359Hrs: *Software Setup***
  - 2 days to run and demonstrate software to judges.  
**Thursday SGT (UTC+8) 0000Hrs – Friday SGT (UTC+8) 2359Hrs: *Running and demonstrating of Software to judges (Statistics and results will be captured)***
- 6.4. A video conference zoom session will be set up for participants to present their solution and results (limited to 15mins) with interview from the judges prior to the data transfer demonstration test.

The agenda of the video conference as below:

1. Presentation of solution and results to judges (15mins)
2. Live demo
3. Interview and questions from judges
4. Any other business (AOB)

The video conference is expected to last 1-2hrs

- 6.5. Successful test runs result to be input to Results Form (provided later) to be submitted to DMC Committee for challenge evaluation.

During the test run and demonstration, bandwidth monitoring and statistics will be captured at NSCC switch connected to NSCC DTN.

Note:

- The Memory to Memory test must ONLY employ the solution implemented by each participating team
- The same protocol used for Disk to Disk transfer test must be employed for Memory to Memory transfer tests
- No other tools capable of doing memory to memory transfers (e.g. iperf3) can be used at the same time.
- The source (input) and destination (output) of the memory to memory tests must be clearly stated by each competing team.
- The MD5 checksum of the overall MD5 checksums of all the files is to be reported to verify the integrity of data transferred after each transfer is complete.
- As the DTN system time will be local to the partner's locale, participants will be required to convert and display system timestamps (expressed in SGT) captured in logs before, during and after running the tests for easy referencing and comparison.



## 8. Frequently Asked Questions (FAQs)

1. Who can the participants contact for enquiries and for technical support during the Data Mover Challenge (DMC)?

Please contact [datamoverchallenge@nscg.sg](mailto:datamoverchallenge@nscg.sg) for enquiries and for technical support during the challenge.

2. Who will schedule the video conference session and how will participants be notified?

The DMC Committee will send an email with a calendar invite to the participants with details of the video conference session, on the Monday of their scheduled challenge week.

3. What are the sizes of the individual files which make up the 2TB dataset?

The Dataset comprises of mixed data types (Genome and Satellite) and sizes ranging from 4KB to 108GB.

4. Can SSH private-public key pairs based authentication be set up from participant to NSCC DTN public IP for password-less access?

Yes, that arrangement can be set up.

5. When will participants receive the details to access the DTN network?

The access information will be sent to participants on the Friday before the challenge week scheduled for the team. The access will be enabled on the following Monday 0000Hrs SGT (UTM+8) of the week scheduled for the team.

6. Can participants deploy their solutions using other methods besides Singularity?

As participants will be provided non-root access into the DTNs, participants are recommended to deploy their solution using Singularity containers which allow applications to install and run without root permission.

7. Can participants request for root or administrator access to the DTNs system and BIOs configuration?

For any tuning of the BIOs or host configuration which requires sudo / root administrator permission, please send the detailed requirement documentation to the DMC committee for the committee's approval. If approved, the configuration will then be implemented by DMC system administrators.

8. Where can participants view the DTNs hardware specifications and disk fio test results?

Participants can find the hardware specifications and fio test results of the DMC DTNs at (link to be provided later).

9. How do participants access the DTNs?

Participants will provide the public IP address they will login from. Access instructions and user account will be provided in due time. Participants will SSH from the provided public IP address to nscg01 DTN. From nscg01 DTN, participants can login to the other DTNs via ssh from the 100G vlan 1312 interface.

10. Would we get a Layer 2 network, or and Layer 3 network for the challenge?

It will be a single VLAN layer 2 network with DTN configured with ip addressing in the same subnet.

11. Would IP multicast be enabled?

IP multicast will not be supported.

12. Would the competition be about transferring bulk data or streaming data?

Bulk data will be used for the dataset transfer.

13. Would we have access to bare metal servers?

Participants will have non root access to install and set up their software on Singularity containers running on the DTNs.

14. Do you plan to include reproducibility as one of the judging criteria for the challenge?

Yes, participants are required to demonstrate their software and data transfer results to the judges.

## **Annex A: Singularity v3.2 installation guide**

Singularity must be installed as root to function properly.

### Install system dependencies

```

$ sudo apt-get update && sudo apt-get install -y \
build-essential \
libssl-dev \
uuid-dev \
libgpgme11-dev \
squashfs-tools \
wget \
git

```

### Install Go

Singularity 3.0 is written primarily in Go, and you will need Go installed to compile it from source. First, visit the Go download page and pick the appropriate Go archive ( $\geq 1.11.1$ ). Copy the link address and download with wget like so:

```

$ export VERSION=1.11 OS=linux ARCH=amd64
$ cd /tmp
$ wget https://dl.google.com/go/go$VERSION.$OS-$ARCH.tar.gz

```

Then extract the archive to /usr/local

```

$ sudo tar -C /usr/local -xzf go$VERSION.$OS-$ARCH.tar.gz

```

Finally, set up your environment for Go

```

$ echo 'export GOPATH=${HOME}/go' >> ~/.bashrc
$ echo 'export PATH=/usr/local/go/bin:${PATH}:${GOPATH}/bin' >> ~/.bashrc
$ source ~/.bashrc

```

### Clone the Singularity repository

Go is a bit finicky about where things are placed. Here is the correct way to build Singularity from source

```

$ mkdir -p $GOPATH/src/github.com/sylabs
$ cd $GOPATH/src/github.com/sylabs
$ git clone https://github.com/sylabs/singularity.git
$ cd singularity

```

### Compile the Singularity binary

```

$ cd $GOPATH/src/github.com/sylabs/singularity
$./mconfig
$ make -C builddir
$ sudo make -C builddir install

```

### **Annex B: DTN servers sysctl tuning guide**

Add ESnet parameter values to /etc/sysctl.conf

```

cat << EOF >> /etc/sysctl.conf
net.ipv4.tcp_congestion_control=htcp
net.ipv4.tcp_mtu_probing=1
#net.ipv4.tcp_no_metrics_save=1
#net.ipv4.tcp_low_latency=1
net.core.rmem_max=2147483647
net.core.wmem_max=2147483647
net.ipv4.tcp_rmem=4096 87380 2147483647
net.ipv4.tcp_wmem=4096 65536 2147483647
net.core.default_qdisc=fq
Disabling rp_filter
net.ipv4.conf.default.rp_filter = 0
net.ipv4.conf.all.rp_filter = 0
Disable ip_forward
net.ipv4.ip_forward = 0
EOF

Apply the changes
sysctl -p

```

### **Annex C: 100G interface tuning script**

-----

Download from <https://gist.github.com/youf3/aa6a93f392a724ea1183e6618ee21957>



TuneDTN.py

Please set the interfaces variable with the name of the interface

#### Pre-requisites

Mellanox OFED installed

yum install pciutils

yum install libnl3-devel

yum install ethtool

yum install python34-pip

yum install python34-devel

pip3 install ethtool

#### Running the script

python3 TuneDTN.py

**Annex D: Disk FIO script**

Copy the sca20\_fio.sh to DTN storage location and run the FIO script to collect results for documentation



sca20\_fio.sh

An example of results output



fio\_result.txt

**Annex E: lshw command**

Run lshw command on DTN and collect output

An example of results output



nsc01-lshw.txt

## **Annex F: Example Singularity Recipe to build Containers**

Example Singularity recipe for a node.js http server, wget and aria2

---

```
Singularity recipe to build an image to run nodejs http server
ajh900 (5-Nov-2018)
```

```
Bootstrap: docker
From: centos
```

```
%runscript
 exec echo "Centos7 image for use with nodejs"
```

```
%files
 # src dest
```

```
%environment
 # export XYZ=/blah/
```

```
%labels
 AUTHOR ajh900@nci.org.au
```

```
%post
 #echo "The post section is where you can install, and configure your container."
 #
 yum -y install deltarpm
 yum -y update && yum -y install epel-release openssl openssl-dev
 #rpm -Uvh http://li.nux.ro/download/nux/dextop/el7/x86_64/nux-dextop-release-0-5.el7.nux.noarch.rpm
 yum -y install wget bzip2 aria2
 yum -y install tmux atop dstat
 yum -y install yum-utils
 yum -y install nodejs npm
 npm install http-server -g
```

---

Example Singularity recipe for Globus:

```

Singularity recipe to build an image to run globus
mgn900 (20180717)

Bootstrap: docker
From: centos

%runscript
 exec echo "Centos7 image for use with globus"

%files
 # src dest

%environment
 # export XYZ=/blah/

%labels
 AUTHOR ajh900@nci.org.au

%post
 #echo "The post section is where you can install, and configure your container."
 #
 yum -y update && yum -y install epel-release openssl openssl-dev
 yum -y install git wget bzip2 aria2
 yum -y install tmux atop dstat
 yum -y install yum-utils
 #
 # Install the globus repo
 # Manually download and create a directory for GPG key
 mkdir -p /etc/pki/rpm-gpg
 wget https://downloads.globus.org/toolkit/gt6/stable/repo/rpm/RPM-GPG-KEY-Globus -O /etc/pki/rpm-
gpg/RPM-GPG-KEY-Globus
 yum-config-manager --add-repo https://downloads.globus.org/toolkit/gt6/stable/repo/rpm/globus-toolkit-6-
stable-el7.repo
 yum-config-manager --enable Globus-Toolkit-6-el7
 yum install -y globus-data-management-client
 #
 # Additional globus setup goes here

 # install conda and gdal
 #sh /tmp/Miniconda3-latest-Linux-x86_64.sh -b -f -p /opt/miniconda3
 #export PATH=/opt/miniconda3/bin:$PATH
 #conda install -y gdal pillow requests
 #
 # make mount points
 #mkdir -p /g/data/fj7 /g/data/gv1

```

Example Singularity recipe for Java, ffmpeg:

-----  
# Singularity recipe to build an image to run ffmpeg  
# ajh900 (5-Nov-2018)

Bootstrap: docker  
From: centos

%runscript  
exec echo "Centos7 image for use with ffmpeg"

%files  
# src dest

%environment  
# export XYZ=/blah/

%labels  
AUTHOR [ajh900@nci.org.au](mailto:ajh900@nci.org.au)

%post  
#echo "The post section is where you can install, and configure your container."  
#  
yum -y install deltarpm  
yum -y update && yum -y install epel-release openssl openssl-dev  
#rpm -Uvh [http://li.nux.ro/download/nux/dextop/el7/x86\\_64/nux-dextop-release-0-5.el7.nux.noarch.rpm](http://li.nux.ro/download/nux/dextop/el7/x86_64/nux-dextop-release-0-5.el7.nux.noarch.rpm)  
yum -y install wget bzip2 aria2  
yum -y install tmux atop dstat  
yum -y install yum-utils  
yum -y install java-1.8.0-openjdk  
  
# Additional tools go here  
-----