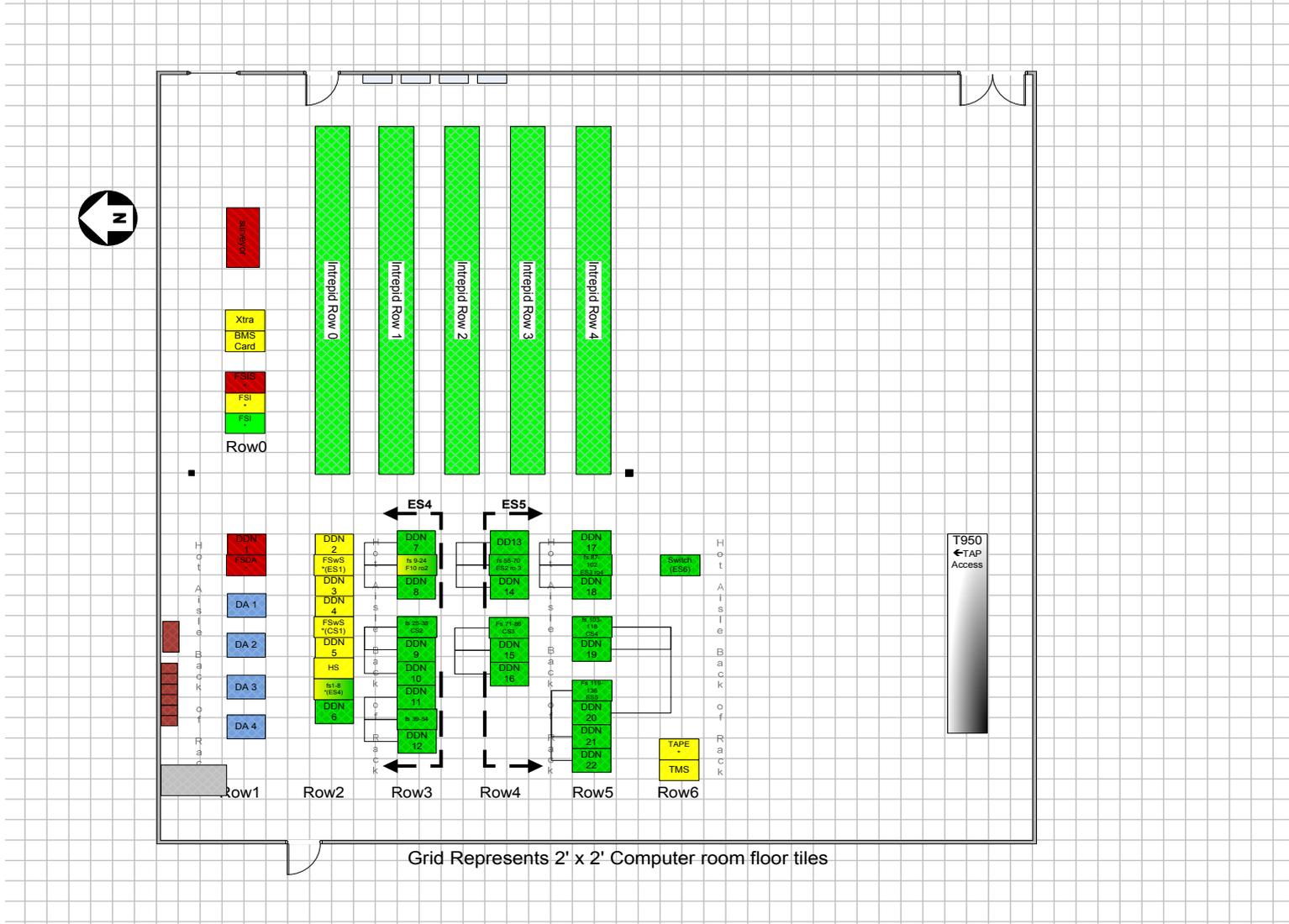


# ALCF Infrastructure Getting Started Workshop

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# The World Inside The ISSF



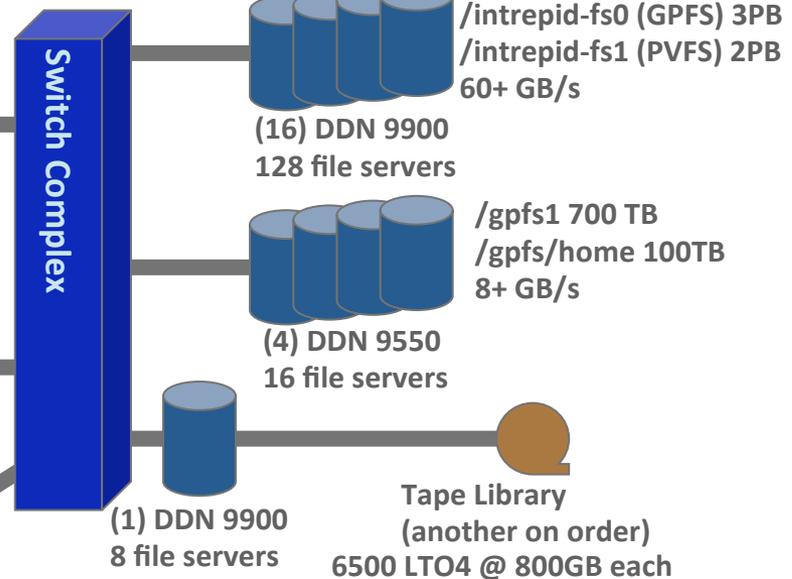
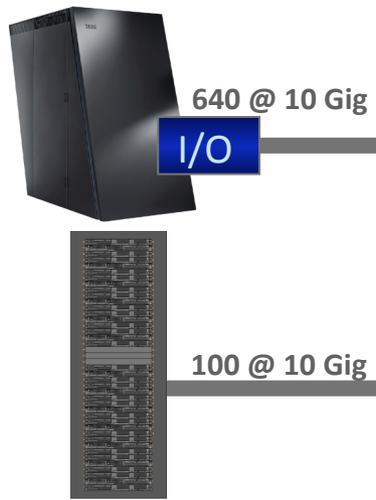
Grid Represents 2' x 2' Computer room floor tiles

# ALCF Resources

INCITE

**Intrepid**  
 557 TF  
 40K 850 MHz nodes  
 160K cores  
 80TB RAM

**Eureka**  
 111TF (SP)  
 (100) 2.0 GHz nodes  
 800 Cores  
 3.2 TB RAM  
 200 Nvidia FX5600

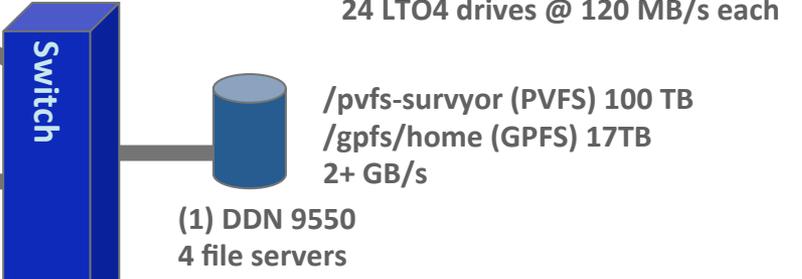
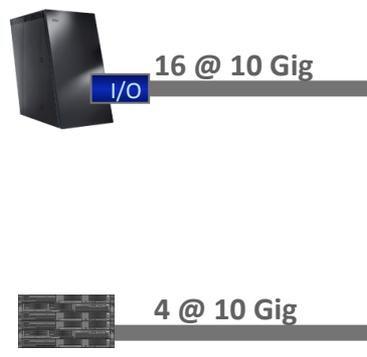


USER TEAMS  
 (via ESnet, Internet2,  
 MREN )

T&D

**Surveyor**  
 13.9 TF  
 1K 850 MHz nodes  
 4K cores  
 2TB RAM

**Gadzooks**  
 4.4 TF (SP)  
 (4) 2.0 GHz nodes  
 32 Cores  
 128 GB RAM  
 8 Nvidia FX5600



# System Details

Blue Gene /P System	Surveyor	Intrepid (8 racks)
Function	Test & Development	Production INCITE
Login address	surveyor.alcf.anl.gov	intrepid.alcf.anl.gov
Login OS	SLES 10 SP 2	SLES 10 SP 2
Login CPUs	4 PPC970MP @ 2.5 GHz	4 PPC970MP @ 2.5 GHz
Login memory	4GB	4GB
BGP CPU (quad core)	850MHz PPC450fp2	850MHz PPC450fp2
BGP # Nodes / # Cores	1024 / 4096	40,960 / 163,840
BGP Memory	2TB (2GB per node)	80TB (2GB per node)
# Round robin (1/64 ratio) place you @ on a login node named login1..@.10 Giga	16 @ 10 Giga	64 @ 10 Giga
BGP Compute OS	CNK, ZeptoOS, Plan 9	CNK, ZeptoOS

• Login to ALCF Resources is via ssh with cryptocard authentication  
 • Logins are for compilation and job submission only;

- You may use parallel make, but be gentle
- Do not do I/O to your home directory



# System Details

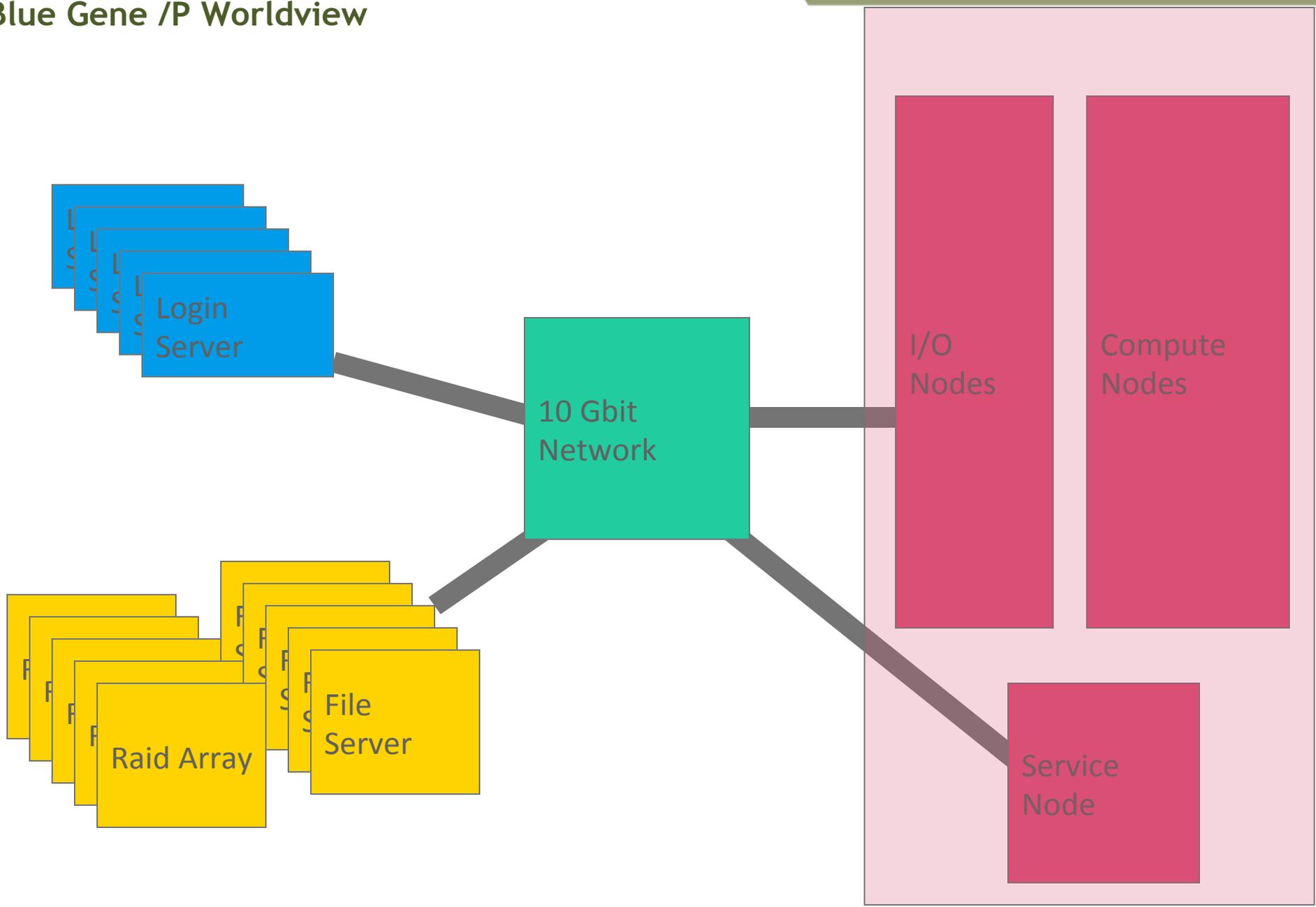
Visualization System	Gadzooks	Eureka
Function	Test & Development	Production INCITE
Login access	gadzooks.alcf.anl.gov	eureka.alcf.anl.gov
Node OS	SLES 10 SP 2	SLES 10 SP 2
Node CPU (quad core)	2 Intel Xeon E5405 @ 2.00GHz	2 Intel Xeon E5405 @ 2.00GHz
Nodes / Cores	4 / 32	100 / 800
Memory	128GB (32GB per node)	3.2 TB (32GB per node)
Login to ALCF Resources is via ssh with cryptocard authentication NVIDIA FX5600s Interconnect	8 10 GigE (Myrinet)	200 10 GigE (Myrinet)

• Round robin DNS will place you on a login node named login[1..n].<machine>.alcf.anl.gov  
 • Logins are for compilation and job submission only:

- You may use parallel make, but be gentle
- Do not do I/O to your home directory
- Logins are separate from visualization nodes



# Blue Gene /P Worldview



# Blue Gene /P Overview

## Intrepid System

40 Racks



1 PF/s  
144 TB

**Rack** Cabled 8x8x16

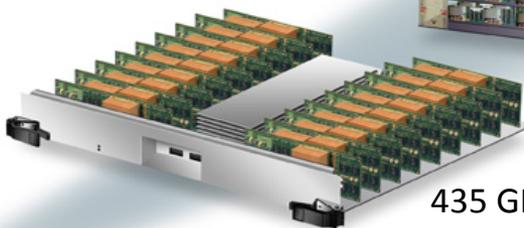
32 Node Cards  
1024 chips, 4096 procs



14 TF/s  
2 TB

### Node Card

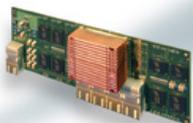
(32 chips 4x4x2)  
32 compute, 0-2 IO cards



435 GF/s  
64 GB

### Compute Card

1 chip, 20  
DRAMs



13.6 GF/s  
2.0 GB DDR  
Supports 4-way SMP

### Chip

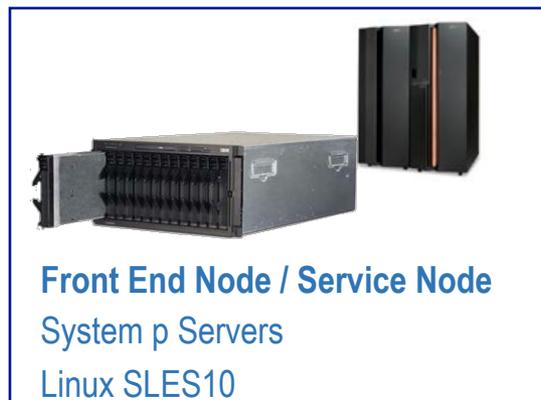
4 processors



850 MHz  
8 MB EDRAM

### Maximum System

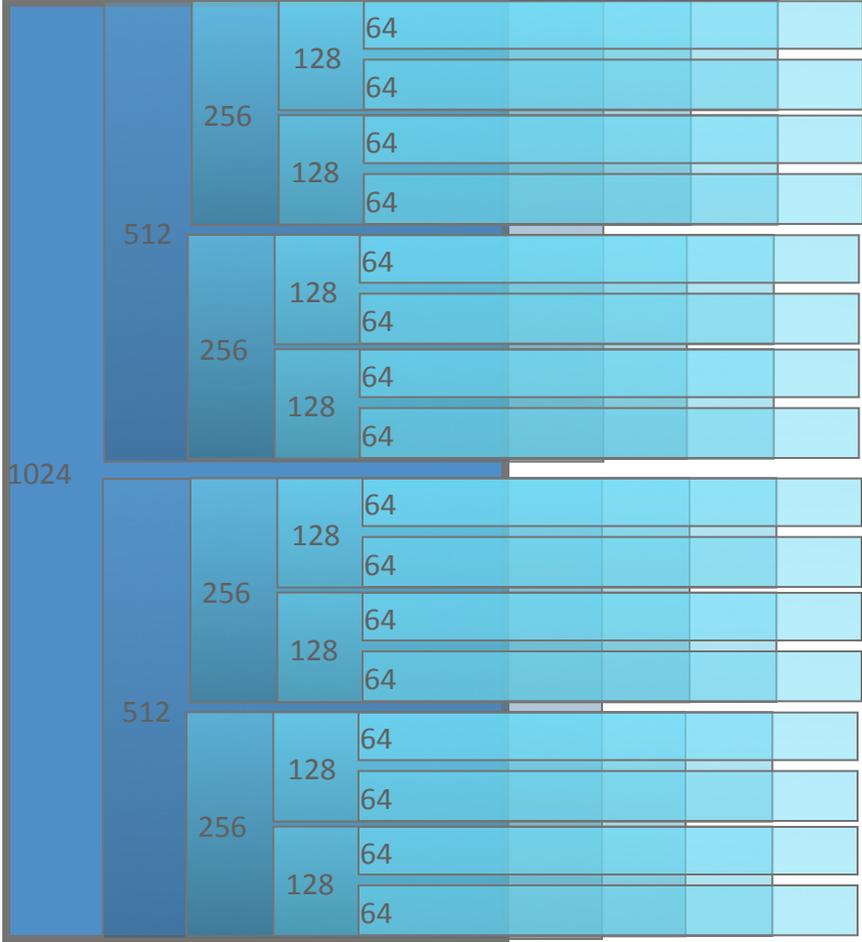
256 racks  
3.5 PF/s  
512 TB



**Front End Node / Service Node**  
System p Servers  
Linux SLES10

**HPC SW:**  
Compilers  
GPFS  
ESSL  
Cobalt

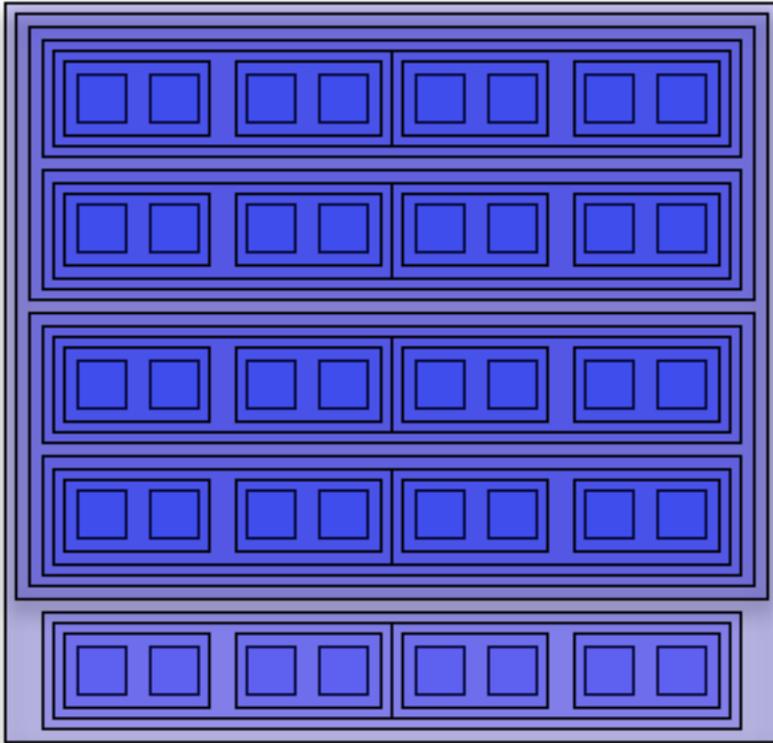
# Blue Gene Single Rack Partitions (“blocks”)



- 1 I/O node for each 64 compute nodes, hardwired to specific set of 64
  - *Minimum partition size of 64 nodes*
- Partition sizes: 64, 128, 256, 512, 1024
  - *Any partition < 512 nodes will get a mesh network layout and not a torus.*
  - *Any partition <512 nodes will get a non-optimal I/O tree network.*
  - *Do not do performance testing on <512 nodes*
- Smaller partitions are enclosed inside of larger ones
  - *Not all partitions are available at all times*
  - *Once a job is running on one of the smaller partitions, no jobs can run on the enclosing larger partitions*
- Configuration changes frequently
  - ***partlist*** shows partition state
- Processes are spread out in a pre-defined mapping, alternate and sophisticated mappings are possible



# Blue Gene Multiple Rack Partitions (“blocks”)



- The following number of large block sizes are possible :
  - 1 40960
  - 1 32768
  - 2 16384
  - 4 8192
  - 9 4096
  - 19 2048
- Not all possible blocks are available at the same time due to wiring dependencies.
- **partlist** will show you if a large free block is busy due to a wiring dependency
- The 40960 node block is generally only available through a reservation
- One rack, R47, is generally reserved for debugging and testing on Intrepid making only the following blocks possible on R4:  
4096, 2 4096
- Mesh partitions are available by reservation only

# Resource Manger and Job Scheduler

- Cobalt - locally developed open source resource manager and scheduler
  - Uses a “cost function” to compute the priority of a job.
- Used on all systems
- Standard commands (qsub, qstat, qdel, qalter)
- Surveyor queues
  - default: Runs the “unicef” cost function; minimize large job starvation while getting good turnaround times
  - Max runtime is 1 hour, no more than 12 jobs running per user, no more than 20 jobs queued per user.
- Intrepid queues
  - prod: Wfp<sup>3</sup> policy; gives priority to larger jobs; will automatically “drain” the machine.
    - Minimum 512 node jobs, max runtime is 12 hours, no more than 5 jobs running per user, no more than 20 jobs queued per user
  - prod-devel: unicef policy (like surveyor)
    - no minimum job size, max runtime is 1 hour, no more than 5 jobs running per user, no more than 20 jobs queued per user

# Reservations

- Reservations
  - Should be the exception not the rule see: <https://wiki.alcf.anl.gov/index.php/Queuing#Reservations> for details
  - Email reservation requests to ***support@alcf.anl.gov***
  - View reservations with **showres**
  - Release reservations with **userres**
- Special reservations
  - R.pm: Preventative maintenance reservation Mondays from 8am to 8am
    - Typically complete in the early evening
  - R.hw\* or R.sw\*: Administrative reservation while addressing hardware or software issues
- This workshop will use:
  - **R.gs11**
  - Please pay attention to reservation constraints with regard to this queue

# Allocation Management

- Every user must have at least one Project they are assigned to
- Projects are then given allocations
  - Allocations have an amount, start, and end date and are tracked separately; Charges will cross allocations automatically. The allocation with the earliest end date will be charged first, until it runs out, then the next, and so on
- Charges are based on the partition size, NOT the # of nodes or cores used!
- Reservations are charged for the full time they are active
- Will be managed with clusterbase
  - Use the 'cbank' command (see 'cbank --help')
- Examples:
  - # list all charges against a particular project
    - `cbank -l charge -p <projectname>`
  - # list all active allocations for a particular project
    - `cbank -l allocation -p <projectname>`

# File systems - Intrepid

- Phase I storage: (4) DDN9550 @ 2.2 GB/s each, (8) fs for home, (16) for GPFS
  - /gpfs/home
    - Intended for source code, binaries, etc.. NOT DATA
    - GPFS, 100TB,
    - Backed up via snapshots and tape
- Local storage on login nodes
  - /scratch is available.
    - XFS, 70GB, relatively fast, temporary
    - NOT mounted on BG/P
    - NOT cross-mounted between nodes

# File systems - Intrepid

- Phase II storage: (16) DDN9900 @ 5.5 GB/s each, 128 file servers
  - /intrepid-fs0
    - Intended for very fast parallel IO, program input and output
    - GPFS, 3 PB, 60+ GB/s
    - Not backed up, but you can initiate archive via HPSS
    - Contains
      - /intrepid-fs0/users/\${USER}/scratch
      - /intrepid-fs0/users/\${USER}/persistent
  - /intrepid-fs1
    - Intended for very fast parallel IO, program input and output
    - PVFS, 2 PB, 50+ GB/s
    - Not backed up, but you can initiate archive via HPSS
    - NOTE: Binaries can not be executed from PVFS
    - Contains
      - /intrepid-fs1/users/\${USER}
  - We strongly prefer that users run from /intrepid-fs0 and write to /intrepid-fs0 or /intrepid-fs1. Job I/O to /gpfs/home is viewed as anti-social and is not supported.



- Phase I storage: (1) DDN9550 @ 2.2 GB/s each, (8) fs for home, (16) for GPFS
  - /gpfs/home
    - Intended for source code, binaries, etc.. NOT DATA
    - GPFS, 15TB,
    - Backed up via snapshots
  - /pvfs-surveyor
    - Intended for fast parallel IO, program input and output
    - PVFS, 88TB
    - Not backed up, CURRENTLY NO TAPE ACCESS
  - We strongly recommend that you avoid writing to /gpfs/home. It is viewed as anti-social and is not supported
- Local storage on login nodes
  - /scratch is available.
    - XFS, 70GB, relatively fast, temporary
    - NOT mounted on BG/P

# Backups and Archival

- Backups
  - Snapshots of home directories are done nightly
    - ~/snapshot
  - home directories are also backed up to tape
    - have not had a single restore request from users
  - Data directories will not be backed up
- Archives
  - Archive service is available via HPSS
    - HSI is an interactive client
    - HTAR is great for lots of small files
      - Path name is limited to 155 chars in the prefix and 100 bytes for the name (prefix/name)
      - File size is limited to 64 GB.
  - GridFTP access to HPSS is available
    - Should be significantly faster

# Getting data in and out

- GridFTP is also available to move data in and out of the site
  - Other site must accept our CA
  - ssh / cryptocard access available
- Obviously scp is also available
  - If you must use scp, eureka is a better system to scp to from all paths will be the same as they are on Intrepid
  - Eureka is also a better host for compressing and uncompressing large file archives

- For each Blue Gene resource there are two mailing lists.
- Visualization resource related announcements are sent to the mailing list of the associated Blue Gene
- <resource>-users@alcf.anl.gov
  - Mandatory, auto-built from all users with active accounts
  - Important announcements impacting the entire community
    - Security issues
    - Major downtimes
    - Policy changes
    - Long-term news
- <resource>-notify@alcf.anl.gov
  - For the active community
  - Operational status announcements
  - Initially subscribed with account creation
  - Subscribe/unsubscribe as you wish

- Argonne computer user agreements
  - Agreed to at account request time
- Standard Argonne computer security rules apply
  - No sharing accounts
    - We WILL know if, for instance, you are letting your grad student use your account.
  - Acceptable use
  - Etc.
- No passwords are allowed for accessing the systems
  - SSH keys used to access Surveyor
  - CRYPTOCard token required to access Intrepid
    - CRYPTOCard tokens will work for Surveyor as well
- Data policies are available on the web:
  - <http://www.alcf.anl.gov/support/usingALCF/docs/dataprivacy.php>
  - If you have prohibited data (PII, UNCI, etc.) please contact [support@alcf.anl.gov](mailto:support@alcf.anl.gov)

# When things go wrong... logging in

- Check to make sure it's not maintenance
  - Often login nodes on both BG/P and data analytics systems are closed off during maintenance to allow for activities that would impact users
  - There should be a mention in the bi-weekly maintenance announcement and the pre-login banner message
  - An all-clear will be sent out at the close of maintenance
- Check your password
  - Remember that CryptoCARD passwords
    - Require a pin at the start
    - Are all uppercase
    - Are all hexadecimal characters (0-9, A-F)
  - Try a fresh password
  - Walk through the unlock and resync steps at:  
[https://wiki.alcf.anl.gov/index.php/User\\_Support#My\\_Cryptocard\\_isn.27t\\_working.\\_How\\_do\\_I\\_proceed.3F](https://wiki.alcf.anl.gov/index.php/User_Support#My_Cryptocard_isn.27t_working._How_do_I_proceed.3F)
- Connect with **ssh -vvv** and record the screen output, your ip address and hostname, and the time that you attempted to connect. Include this information in any ticket to speed debugging

## When things go wrong... running

- Cobalt jobs, by default, produce three files prefixed with either the job number or the name specified with qsub's **-O** option:
  - **\$PREFIX.output** with output to standard out from you application
  - **\$PREFIX.error** with output from the control system, scheduler, and your application directed to standard error
  - **\$PREFIX.cobaltlog** with a record of the environment and the submission command
    - Generated at submit time
    - Very useful for the support team in debugging
- Only cobaltlog is generated at submit time, the others at runtime
- At boot, the .error file will have a non-zero size for non-script jobs
  - Most of the messages are related to booting, it's a decent way to follow startup progress
  - Script jobs leave the handling of standard error up to you, though most do use the .error file
  - We'll walk through a normal boot in a moment...
- If you think there is an issue, it's best to save all three files



## When things go wrong... running

- You'll see RAS events appear in your .error file it's not always the sign of trouble
- RAS stands for Reliability, Availability, and Serviceability
- Few are a sign of a serious issue, most are system noise
  - Messages have a severity associated with them
    - INFO
    - WARN
    - ERROR
    - FATAL
  - Only FATAL RAS events will lead to the termination of your application
  - Still worth watching as they may be the sign of an application issue
- The most common RAS event is **APPL\_0A2B**
  - Accounts for 58% of all RAS events over the last year
  - an INFO RAS event meaning the DMA unit reception FIFO is full
  - Sign of an application issue that impacts performance
    - Applications are posting too many sends before receives
    - Less severe cases may be addressed through tuning the DCMF\_REC\_FIFO variable size
  - Totally preventable



Remember:  
The VelociRAStor says only you can prevent **RAS Events**

# Getting Help

## Problems or Questions:

### Check:

- Getting Started: <http://www.alcf.anl.gov/support/usingALCF/usingsystem.php>
- ALCF Wiki: [https://wiki.alcf.anl.gov/index.php/Main\\_Page](https://wiki.alcf.anl.gov/index.php/Main_Page)
- ALCF web pages: <http://www.alcf.anl.gov>
- Intrepid Status: <http://status.alcf.anl.gov/intrepid/activity> (beta, a.k.a. The Gronkulator)

### Contact:

- e-mail: [support@alcf.anl.gov](mailto:support@alcf.anl.gov)
- phone: **630-252-3111 (866-508-9181)**
- Your catalyst

Thanks for listening!  
Any questions?