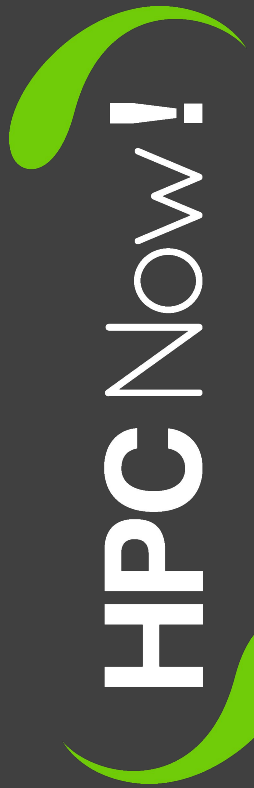



# Addressing Tomorrow's Challenges Today

Jordi Blasco
CTO & Co-founder

NZ SKA Forum 2019 - Auckland

## System Administrators and User Support

## Top500 Supercomputer Users

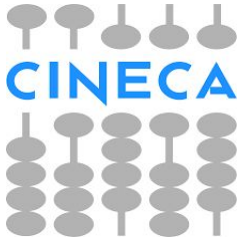


CENTRE DE SUPERCOMPUTACIÓ DE CATALUNYA





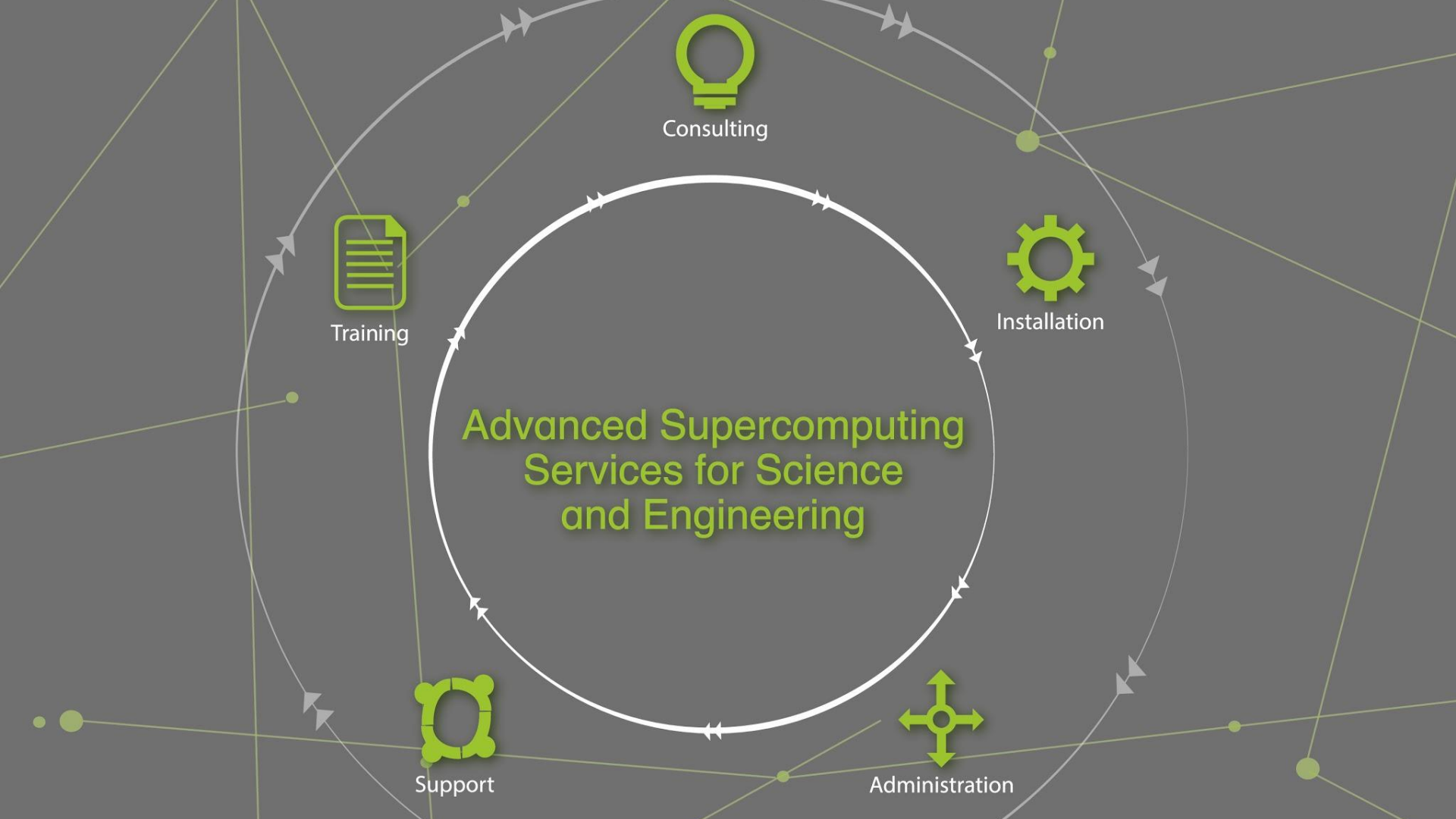
Barcelona Supercomputing Center
Centro Nacional de Supercomputación



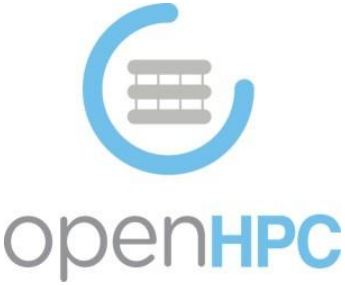


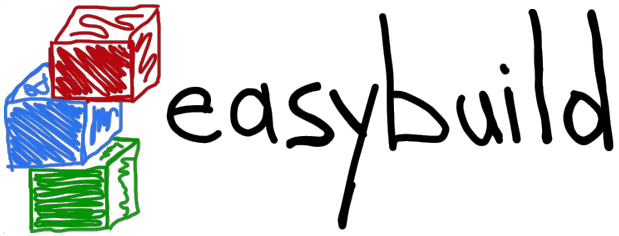
Reference Network on Theoretical and Computational Chemistry

- IT + scientific background
- HPC services and solutions
- User-oriented company
- Hardware agnostic


Consulting
Training
Installation
Advanced Supercomputing Services for Science and Engineering
Support
Administration

# Contributions to HPC Community

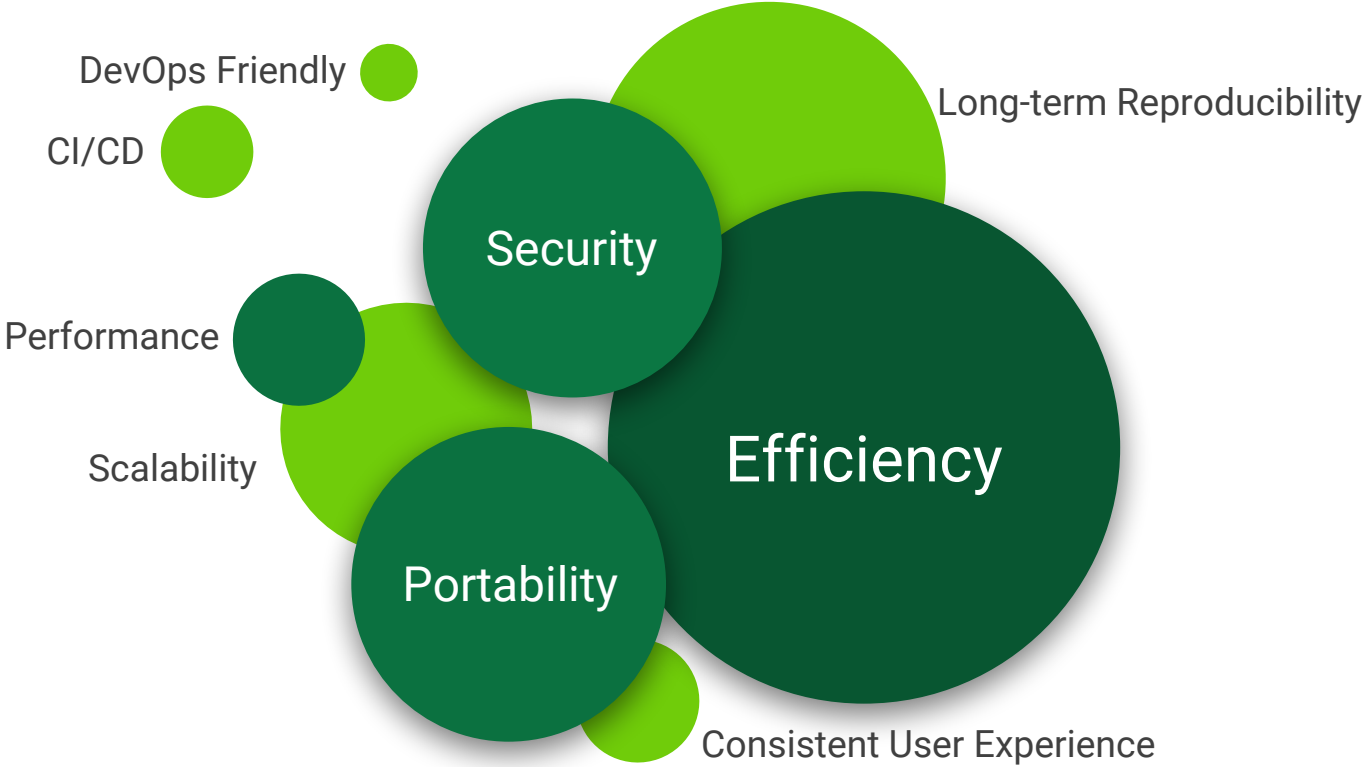






# The time for traditional HPC services is over

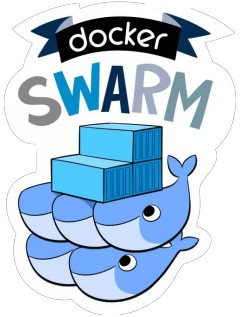
## HPC users need more than just compute solution

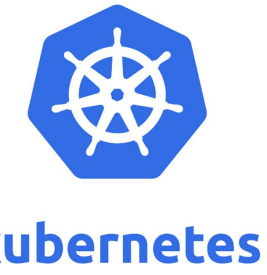


# Key Technologies

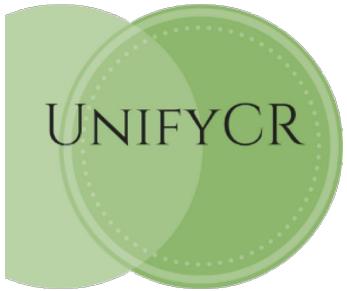
## HPC users need more than just compute solution

### Container Solutions




### Burst Buffers





### Cloud Bursting



### Efficiency Monitoring


# Case Studies
## Long-term reproducibility

Pfizer has a need for at least 10 years reproducibility. HPCNow! provides ongoing support to adopt Singularity in order to cover this need, and also achieve portability, performance, CI/CD for scientific software and cloud bursting to AWS.

ENTERPRISE

Microsoft Azure

amazon web services™

Google Cloud Platform

SINGULARITY ENABLES EXTREME MOBILITY

SCP, SFTP, GridFTP/Globus, Rsync, NFS, Lustre, Object Stores, etc..

Single file containers means that containers are easy to manage

Open Science Grid

XSEDE
Extreme Science and Engineering Discovery Environment

PENGUIN COMPUTING

COMPUTE

# Singularity Roadmap

## What is the future of Singularity?

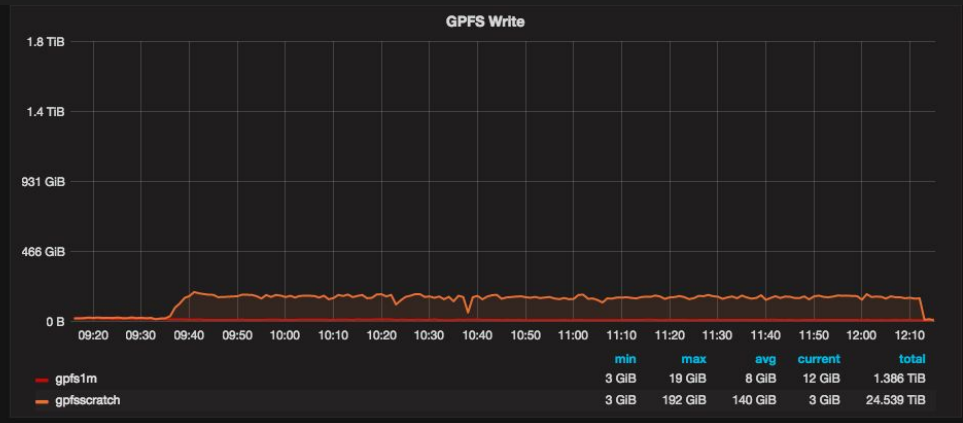
- Singularity 3.1 will introduce **plugin framework** for 3rd party tools.
- Future versions of Singularity will introduce **Kubernetes** integration and the ability to run **encrypted** containers.
- Singularity is already positioned as the container platform for AI, and we are seeing more cutting edge compute scenarios that leverage services and streaming.

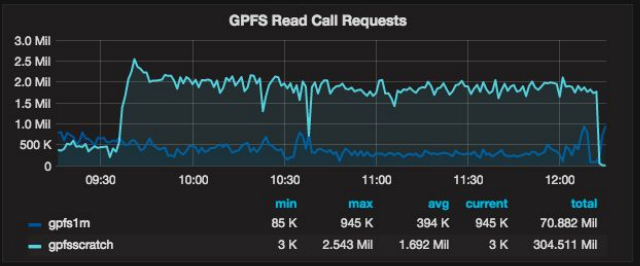
# Case Studies
## High Intensive IO

KAUST was looking for a solution for challenging IO patterns. Small files and high metadata intensive workloads can slow down the complete cluster for a long period of time. HPCNow! architected and installed a BeeGFS solution for KAUST to cover this need.

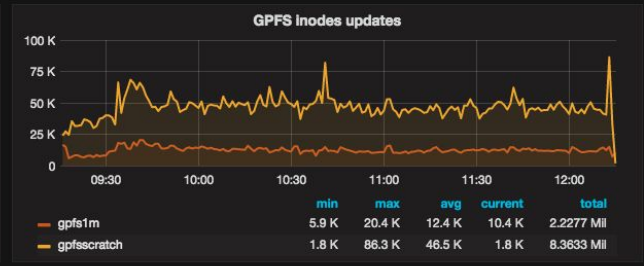
KAUST

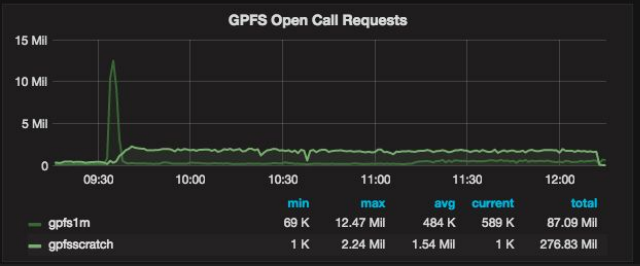

GPFS Read
3.2 TiB
2.7 TiB
2.3 TiB
1.8 TiB
1.4 TiB
931 GiB
466 GiB
0 B
09:20 09:30 09:40 09:50 10:00 10:10 10:20 10:30 10:40 10:50 11:00 11:10 11:20 11:30 11:40 11:50 12:00 12:10
min max avg current total
gpfs1m 37 GiB 97 GiB 56 GiB 61 GiB 9.848 TiB
gpfsscratch 24 GiB 2.918 TiB 1.952 TiB 24 GiB 351.436 TiB

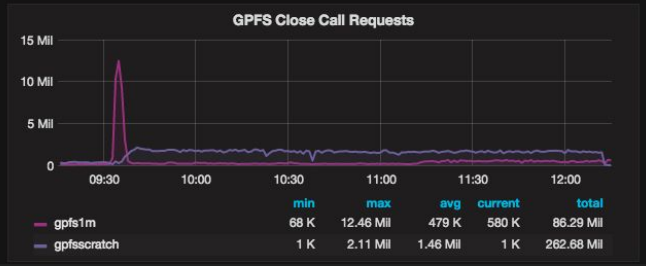

GPFS Write
1.8 TiB
1.4 TiB
931 GiB
466 GiB
0 B
09:20 09:30 09:40 09:50 10:00 10:10 10:20 10:30 10:40 10:50 11:00 11:10 11:20 11:30 11:40 11:50 12:00 12:10
min max avg current total
gpfs1m 3 GiB 19 GiB 8 GiB 12 GiB 1.386 TiB
gpfsscratch 3 GiB 192 GiB 140 GiB 3 GiB 24.539 TiB


GPFS Read Call Requests
3.0 Mil
2.5 Mil
2.0 Mil
1.5 Mil
1.0 Mil
500 K
0
09:30 10:00 10:30 11:00 11:30 12:00
min max avg current total
gpfs1m 85 K 945 K 394 K 945 K 70.882 Mil
gpfsscratch 3 K 2.543 Mil 1.692 Mil 3 K 304.511 Mil

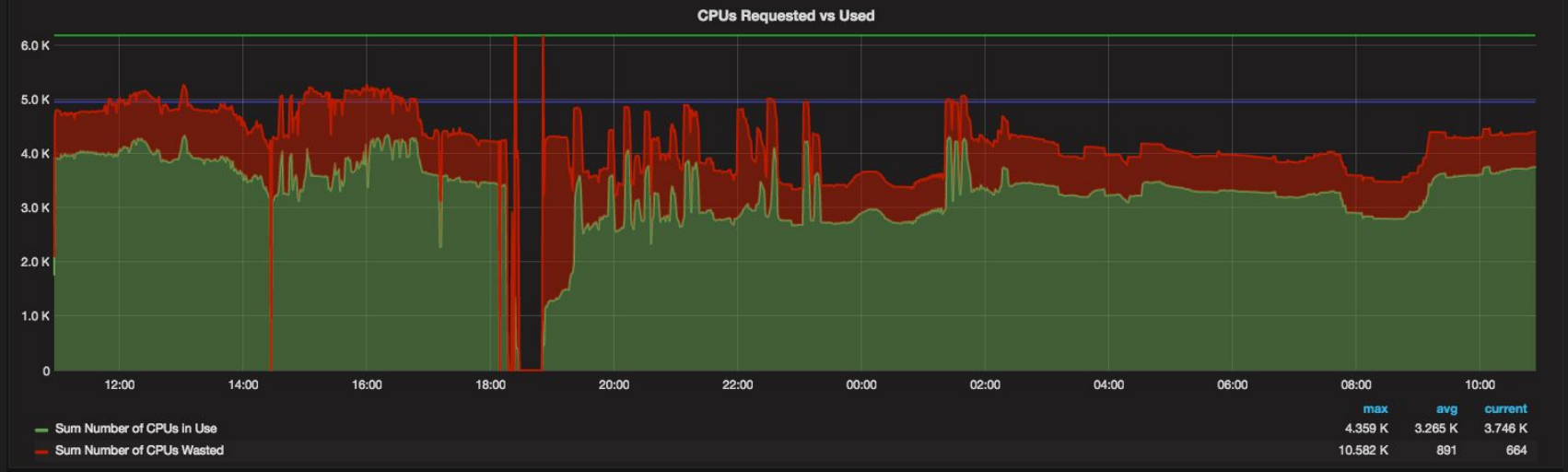

GPFS Write Call Requests
200 Mil
150 Mil
100 Mil
50 Mil
0
09:30 10:00 10:30 11:00 11:30 12:00
min max avg current total
gpfs1m 1.0 Mil 105.3 Mil 65.3 Mil 30.5 Mil 11.7495 Bil
gpfsscratch 3 K 189.0 Mil 127.5 Mil 3 K 22.9569 Bil

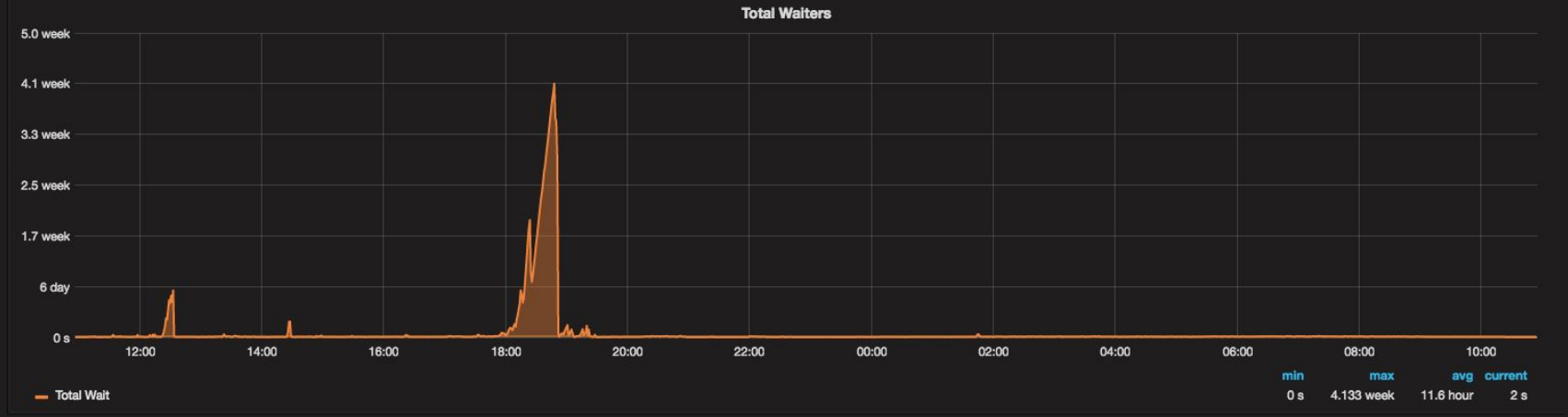

GPFS inodes updates
100 K
75 K
50 K
25 K
0
09:30 10:00 10:30 11:00 11:30 12:00
min max avg current total
gpfs1m 5.9 K 20.4 K 12.4 K 10.4 K 2.2277 Mil
gpfsscratch 1.8 K 86.3 K 46.5 K 1.8 K 8.3633 Mil


GPFS Open Call Requests
15 Mil
10 Mil
5 Mil
0
09:30 10:00 10:30 11:00 11:30 12:00
min max avg current total
gpfs1m 69 K 12.47 Mil 484 K 589 K 87.09 Mil
gpfsscratch 1 K 2.24 Mil 1.54 Mil 1 K 276.83 Mil


GPFS Close Call Requests
15 Mil
10 Mil
5 Mil
0
09:30 10:00 10:30 11:00 11:30 12:00
min max avg current total
gpfs1m 68 K 12.46 Mil 479 K 580 K 86.29 Mil
gpfsscratch 1 K 2.11 Mil 1.46 Mil 1 K 262.68 Mil

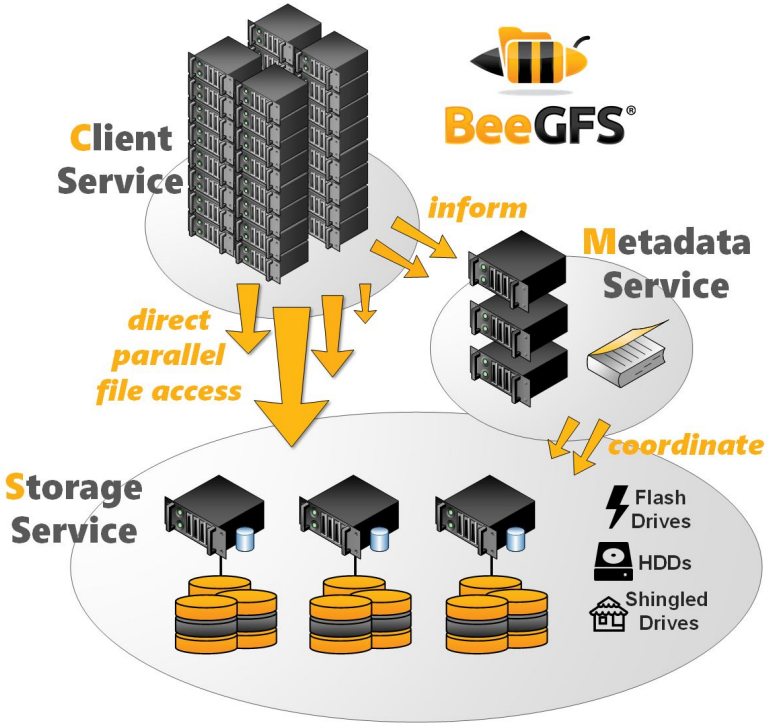

Total Waiters
1.2 day
22 hour
17 hour
11 hour
6 hour
0 s
09:30 10:00 10:30 11:00 11:30 12:00
min max avg current total
Sum Wait 14 min 23.09 hour 14.49 hour 46 min 15.5263 week


CPUs Requested vs Used
6.0 K
5.0 K
4.0 K
3.0 K
2.0 K
1.0 K
0
12:00
14:00
16:00
18:00
20:00
22:00
00:00
02:00
04:00
06:00
08:00
10:00
max
avg
current
Sum Number of CPUs in Use
4.359 K
3.265 K
3.746 K
Sum Number of CPUs Wasted
10.582 K
891
664


Total Waiters
5.0 week
4.1 week
3.3 week
2.5 week
1.7 week
6 day
0 s
12:00
14:00
16:00
18:00
20:00
22:00
00:00
02:00
04:00
06:00
08:00
10:00
min
max
avg
current
Total Wait
0 s
4.133 week
11.6 hour
2 s

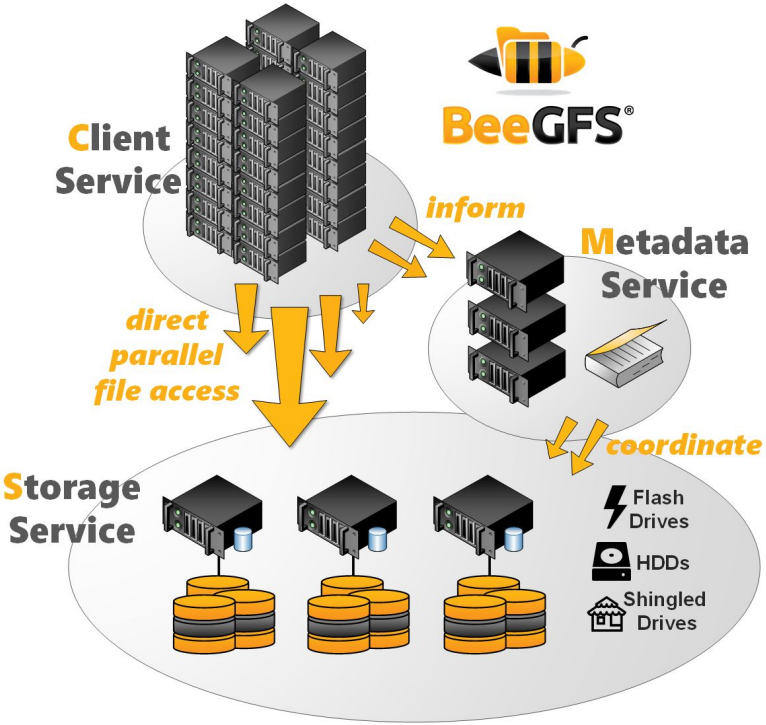
# Addressing Challenging IO Patterns

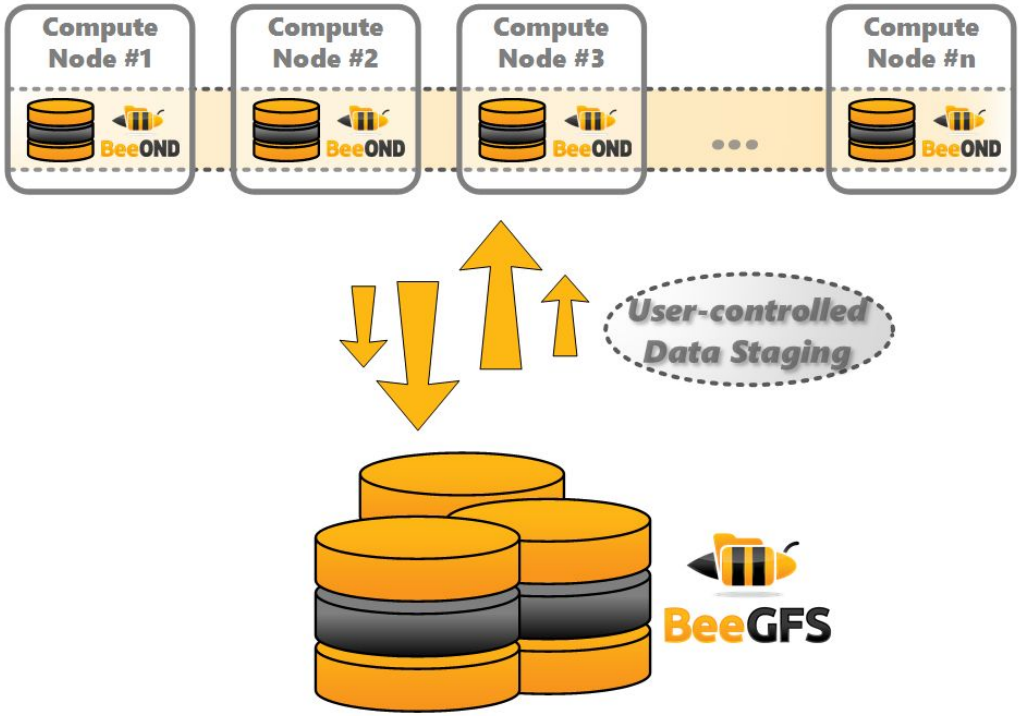
## Isolating and allocating the IO capacity like CPUs or memory



# Addressing Challenging IO Patterns

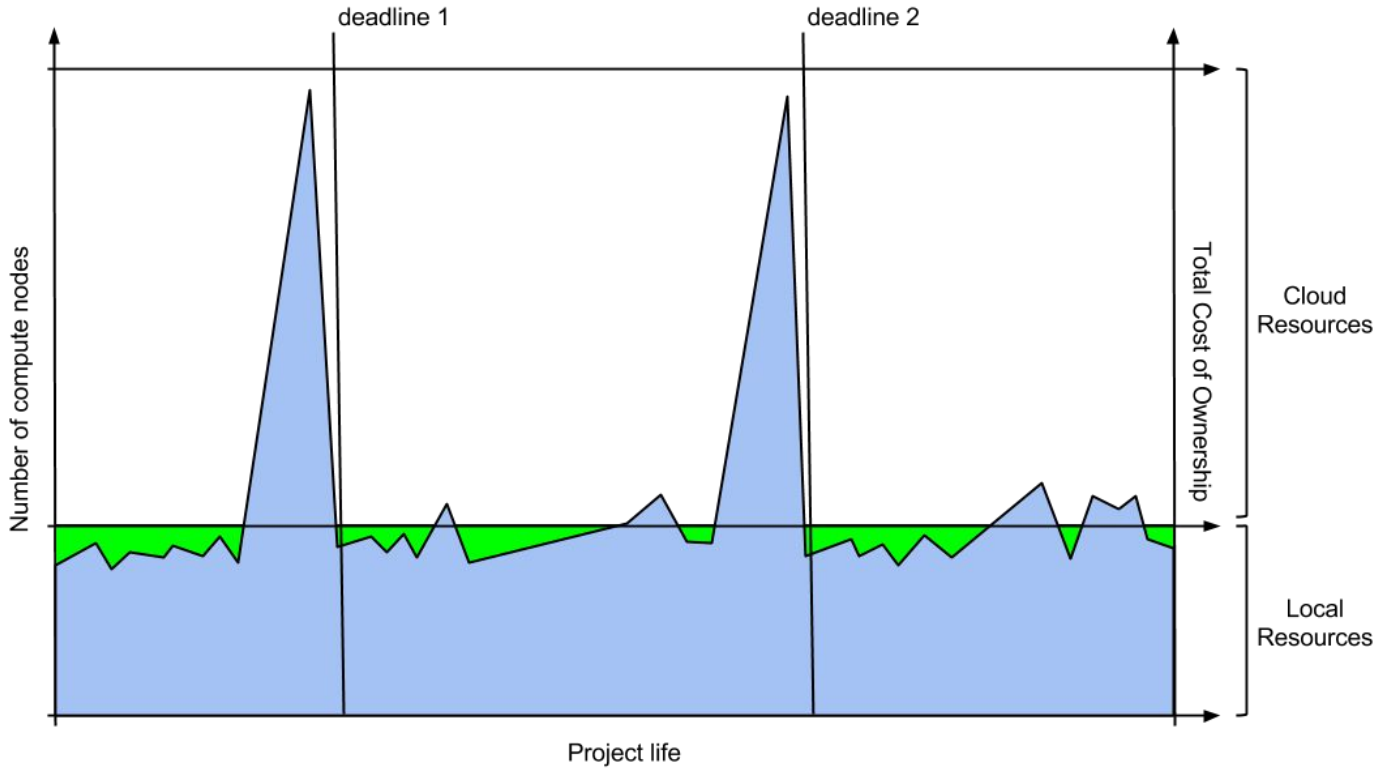
## Isolating and allocating the IO capacity like CPUs or memory



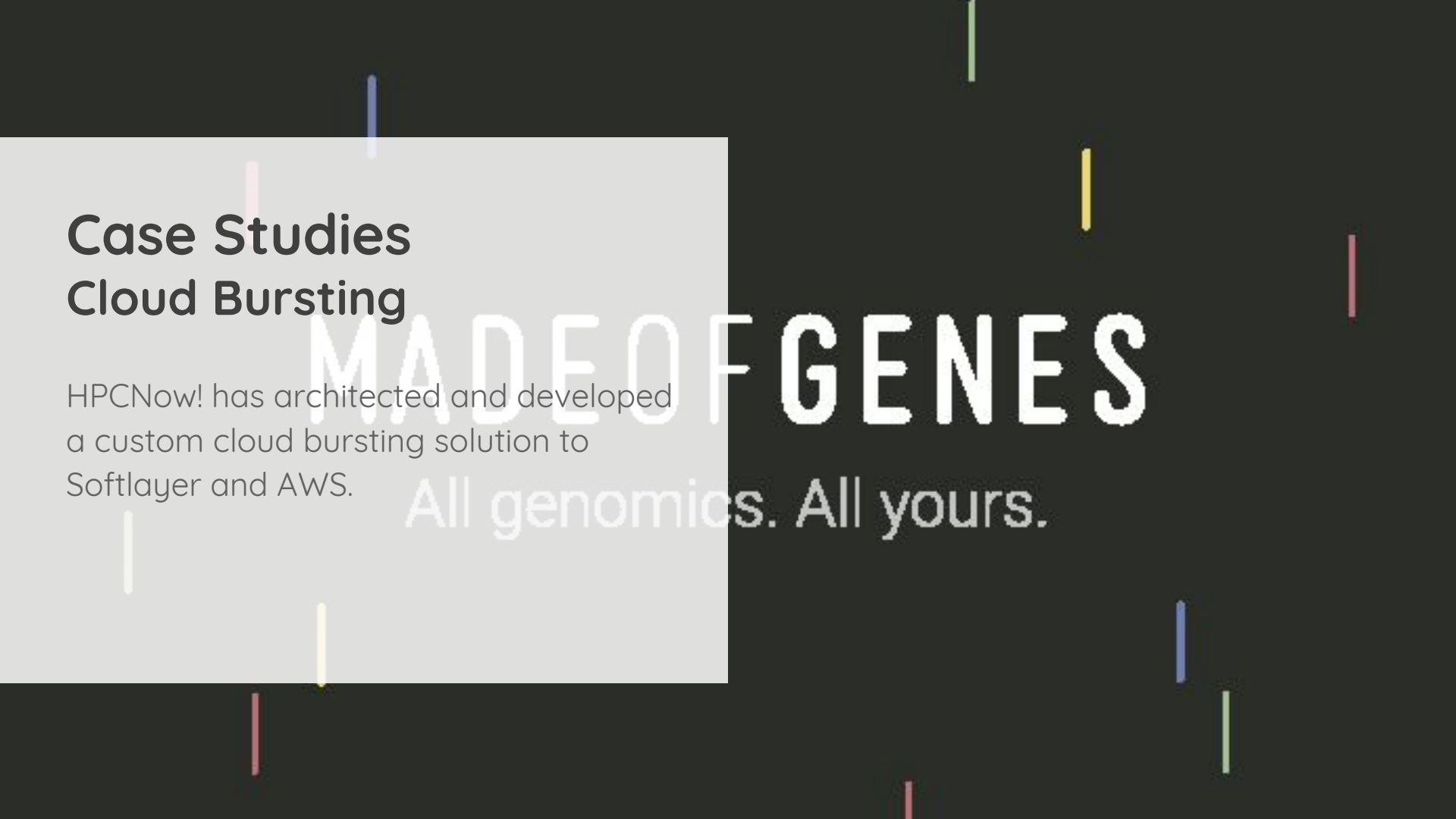
# Cloud Bursting

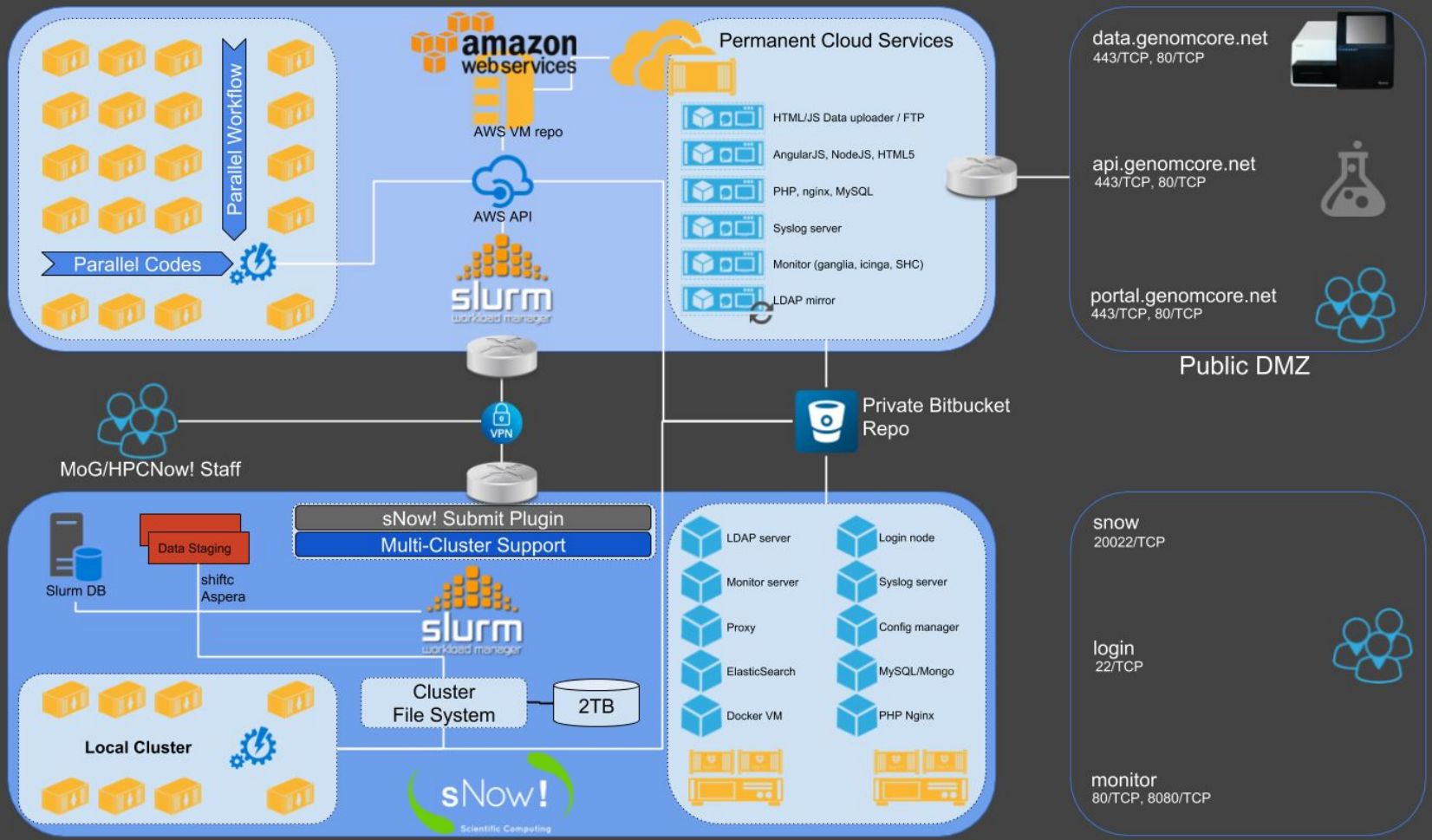
## Extending the Compute Capacity with Hybrid Cloud

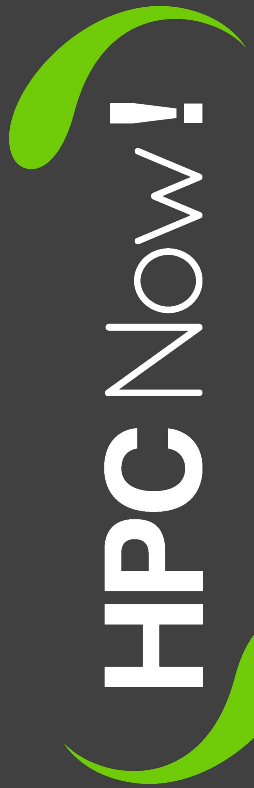


# Case Studies
## Cloud Bursting

HPCNow! has architected and developed a custom cloud bursting solution to Softlayer and AWS.




Parallel Workflow
Parallel Codes
amazon web services
AWS VM repo
AWS API
slurm
workload manager
Permanent Cloud Services
HTML/JS Data uploader / FTP
AngularJS, NodeJS, HTML5
PHP, nginx, MySQL
Syslog server
Monitor (ganglia, icinga, SHC)
LDAP mirror
data.genomcore.net
443/TCP, 80/TCP
api.genomcore.net
443/TCP, 80/TCP
portal.genomcore.net
443/TCP, 80/TCP
Public DMZ
MoG/HPCNow! Staff
VPN
Private Bitbucket Repo
sNow! Submit Plugin
Multi-Cluster Support
Slurm DB
Data Staging
shiftc
Aspera
slurm
workload manager
Local Cluster
Cluster File System
2TB
LDAP server
Monitor server
Proxy
ElasticSearch
Docker VM
Login node
Syslog server
Config manager
MySQL/Mongo
PHP Nginx
sNow!
Scientific Computing
snow
20022/TCP
login
22/TCP
monitor
80/TCP, 8080/TCP

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