



alcesflight

On demand HPC **(or – HPC clusters on your terms)**

@CIUK18 – December 2018



INFRASTRUCTURE



PLATFORM

ENVIRONMENT

Remote Desktop

Job scripts



MPI

File data

Job scheduler

Apps + libraries

Pulp

BeeGFS

Nagios

Docker

AWS EC2

IPA

Lustre

Puppet

AWS S3

Enterprise Block Store

Virtual Private Cluster

master1

node01

node02

node03

disk1

disk2

What is Flight?

An HPC cluster

What does Flight provide?



- One-click **HPC cluster** environment
- CentOS based Linux cluster
 - *Genders* and *PDSH* utility
 - Collaborative graphical desktop
 - Storage management tools
 - HPC job-scheduler
- **Curated HPC user assets**
 - Job-scripts, data locations
 - Application repository
 - Libraries, dependencies, etc.
 - Data sync with persistent storage

```
alces@login1:~
.:+/
./oooot`
`/ooooo.
/ooooo/
oooooo- ./o/
+ooooo/+ooo
-oooooooooooo
:oooooooooooo. `:+`
-+ooooooooo+:ooo`
`:oooooooooooo.
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`-/oooooooo/..-...-:/+ooo//oooo/+oooo/
./oooooooo+oooooooooooooooooooooooooooo/`
.+oooooooooo+oooooooooooooooooooo+:.
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`-/oo+
`-. -[ alces flight ]-

TIPS:
'module avail' - show available application environments
'module add <modulename>' - add a module to your current environment

'alces gridware' - manage software for your environment
'alces howto' - guides on how to use your research environment
'alces session' - start and manage interactive sessions
'alces storage' - configure and address storage facilities
'alces template' - tailored job script templates

'qstat' - show summary of running jobs
'qsub' - submit a job script
'qdesktop' - submit an interactive session request

'aws help' - show help for AWS CLI

's3cmd --help' - show help for S3cmd
's3cmd ls [<bucket>]' - list objects or buckets
's3cmd put <file> <s3>' - put file into bucket
's3cmd get <s3> <file>' - get file from bucket

[alces@login1(scooby) ~]$
```

Alces Gridware Application library



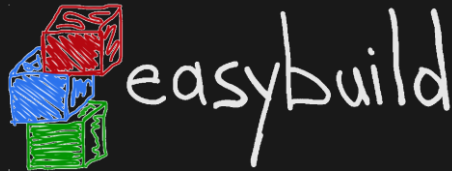
A screenshot of the Alces Gridware Application Library website. The page features a dark blue header with the Alcesflight logo and navigation links for HOME, COMPUTE, SUPPORT, and a user profile. Below the header is a blue "Library" bar. The main content area is a grid of application cards. On the left, there is a sidebar with a search bar and a list of categories with counts: All software (1516), Benchmarks (20), Biochemistry (11), Bioinformatics (788), Chemistry (49), Compilers (2), Databases (2), Deep Learning (2), Fluid Dynamics (15), Geography (4), Graphics (28), Imaging (26), Languages (126), Libraries (283), and Library (2). The application cards include: 'anges' (Bioinformatics, v1.01, 2016-09-26, VOLATILE), 'antlr' (Libraries, v3.1.3, 2013-01-08, VOLATILE), 'antlr' (Libraries, v3.5, 2013-01-08, VOLATILE), 'ants' (Imaging, v1.9.1, 2012-09-08, VOLATILE), 'aragorn' (Bioinformatics, v1.2.36, 2013-12-17, VOLATILE), 'arpack-ng' (Mathematics, v3.3.0, 2016-05-27, MAIN), 'arpack-ng' (Mathematics, v3.3.0, 2016-05-27, MAIN), and 'artemis' (Bioinformatics, v1.2.36, 2013-12-17, VOLATILE).

- Over **1,500** apps, libraries and MPIs
- Includes **modules** environment management
- Support for **commercial** and **licensed** applications

Flight Connections program



- Connect your favourite ISV applications to your clusters
- Manage **subscriptions** and **licenses** from a single point
- Includes support for:
 - **Docker** containers
 - **Singularity** containers
 - **Easybuild** environment



Alces Flight Connections
Working together to help your HPC project take off faster.

Fully tested and proven.
Alces Flight Connections brings together software companies who provide high quality, reliable HPC solutions for cloud and on-premises systems.

Save time and money.
With Alces Flight Connections users are focused on their projects and not wasting time with software installation. By engaging with a fully optimized solution users spend less money on cloud and less time waiting for their on-premises system to deliver.

Access to over 1,300 packages.
Alces Flight Connections also plugs users into Alces Gridware; home to over 1,300 open source packages and counting. Why choose to go anywhere else when you have this much access?

Alces Flight + BeeGFS
Developed by the Fraunhofer Institute for Industrial Mathematics, BeeGFS is a scalable parallel file system developed and optimized for high-performance computing.

The BeeGFS logo features a stylized yellow and black bee above the text "BeeGFS" in a bold, sans-serif font, with "developed by Fraunhofer" in smaller text below.

Self-service HPC on AWS and Azure Marketplace

Alces Flight - auto-scaling HPC clusters instantly ready to compute



- Run your own HPL benchmark on an Alces Flight cluster!
- Single-user, self-managed HPC clusters on-demand
- All you need is a few AWS account to launch



```
1. edward@login-262451~(ssh)
08:04:26 JST 2016 on pts/0

Welcome to el7cluster

      _
     _/ Alces Clusterware (v2016.06)
    _/  Based on CentOS Linux 7.2.1511 (Core)
   _/
  _/
 _/
/_/

TIPS:
'module avail'      - show available application environments
'module add -modulen...' - add a module to your current environment

'alces session'    - start and manage interactive sessions
'alces gridware'  - manage software for your environment
'alces howto'     - guides on how to use your research environment
'alces template'  - tailored job script templates

'qstat'           - show summary of running jobs
'qsub'           - submit a job script
'qdesktop'       - submit an interactive session request

'aws help'       - show help for AWS CLI

[edward@login-262451(el7cluster)] ~$
```

- 1500+ popular scientific applications
 - Pre-installed & ready to run
 - Multiple app versions, complete with libraries and various compiler optimizations, ready to run
- Available via **AWS Marketplace**



Why use flight?

- Convenience
 - Build a cluster **quickly and easily**
 - **Scale to any size** simply at launch or automatically while running
 - **Repeatable** process for training and education
- Performance
 - Flight can **optimize** your applications automatically
 - Choose cloud platform features for HPC; e.g.
 - AWS **enhanced networking** for EC2 instances
 - Instance **Placement groups** to reduce MPI latency
 - **EBS-optimized** for best storage performance

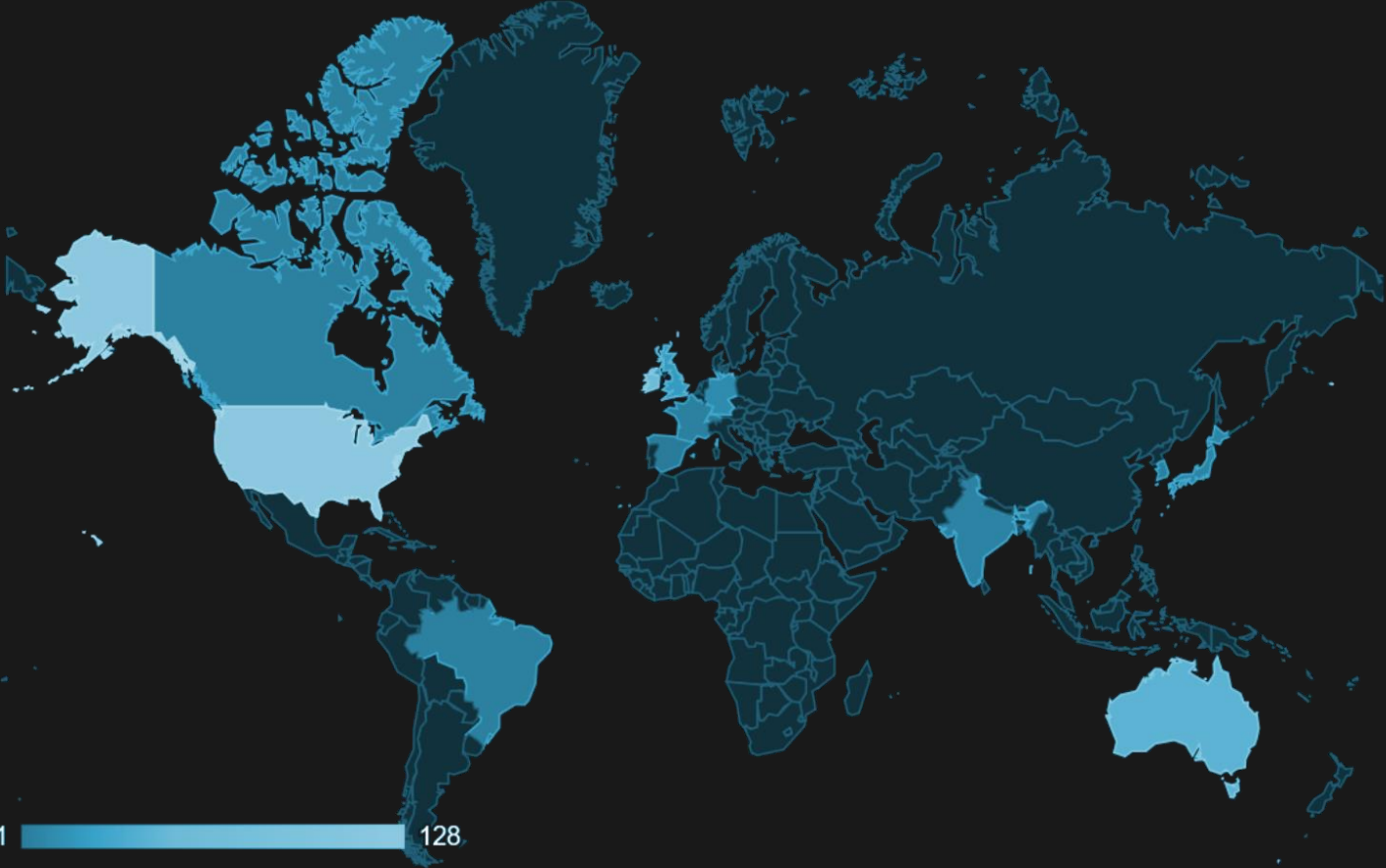


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Worldwide sites using Alces Flight



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CIUK Top500 performance run

- Used 320 x SkyLake 36C 3Ghz nodes (**AWS c5.18xL**)
 - 25Gb interconnect between nodes
- Timescales
 - Used an existing AWS account with high EC2 region limits
 - Alces Flight cluster launched from AWS Marketplace **in 19m 03s**
 - **2m 40s** setup time
 - **4m 15s** cluster launch time (to SSH login)
 - **12 minute** SPOT acquisition time for nodes



CIUK Top500 performance run

- Installed *Benchmark* depot using *Alces Gridware*
- Downloaded *job-script* and HPL.dat file from AWS S3
- Submitted job to *Slurm* job-scheduler
- Achieved **654,124 Gflops**
 - Between #413 and #414 on Top500 list
- Run on AWS in spot market
 - Average node cost **\$1.54/hr***



* based on c5.18xlarge spot rate in EU-West2 region; excludes sales tax where applicable

* November 2017 Top500 list

Approximate costs

- 1 iteration using 11,520 cores taking 3 hours
- Total time:
 - Cost of 320 x C5 instances AWS spot market* = \$1,479
 - Cost of one C4 login node for 3 hours* = \$5.76
 - Cost of 100GB EBS volume for apps* = \$0.02
 - Alces Flight software cost = \$0.00
- **Total cost per iteration = \$1,485***

* based on c5.18xlarge spot rate in EU-West2 region; c4 on-demand instance; EBS st1 volume; excludes sales tax where applicable



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If all you run is HPL...



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- **24x7 usage**, 100% load, all nodes
 - Public cloud is more expensive than on-prem
- Monday-Friday, **9am-5pm**
 - Public cloud is 25% cheaper than buying a physical cluster
- Most HPC workloads are **less demanding** than HPL
 - Use Flight to **auto-scale** your cluster to match demand
 - Choose **different node types** for more flexibility and agility
 - Add-in **GPU** and **FPGA** devices when you need them
 - Launch a cluster when you need it and destroy it when done

The Smart Bit

- Use the correct platform for your work
 - **No platform** is good for everything
- **Value** your own time
 - And that of your users, researchers, scientists, accountants....
- **Agility** is your friend
 - Follow best software-engineering practice
 - Create and reuse repeatable solutions
 - Help your users manage change over time
- Economics are driving the cloud revolution



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What about the innovative stuff?

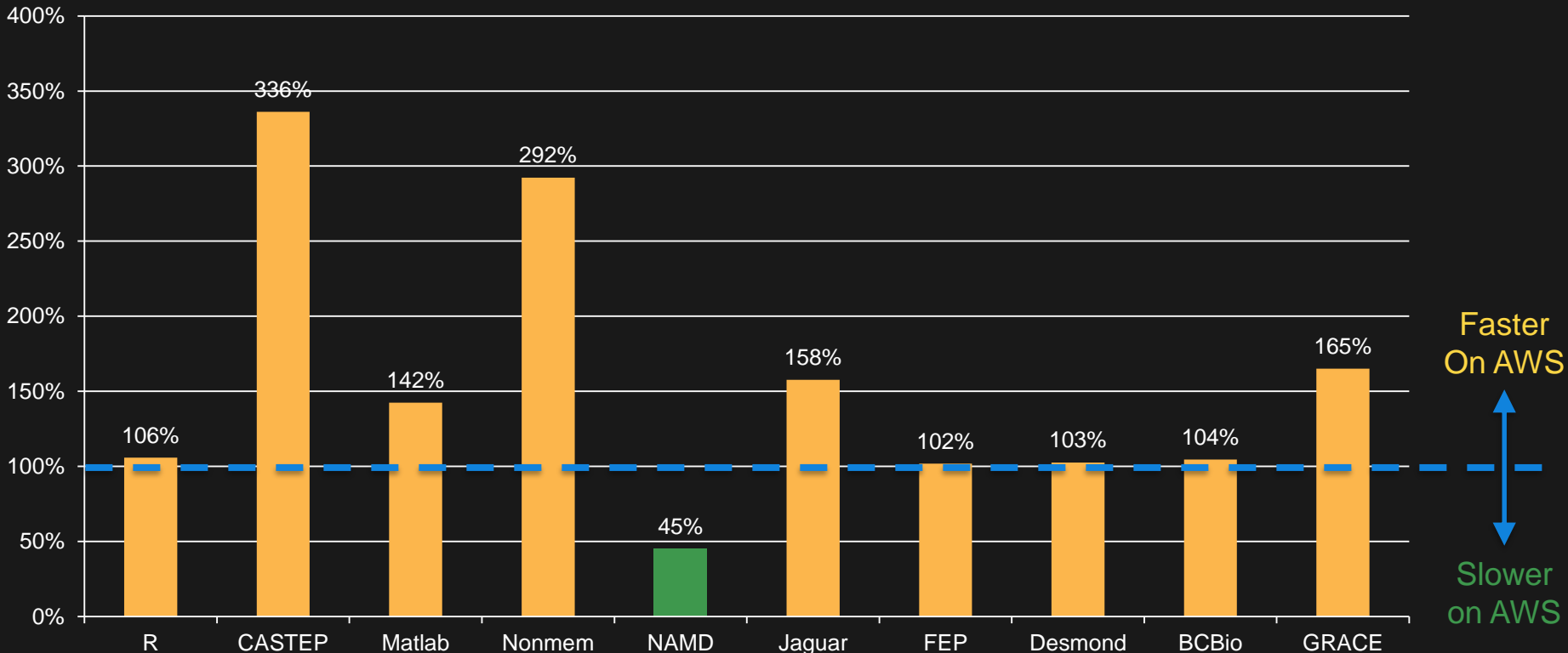


- **Flight allows you to do new things**
 - Quickly install hard-to-get-running applications in a cluster
 - Try out new job-schedulers
 - Create your own development platform to try new things out
 - Try out new hardware
 - Latest GPUs, FPGA devices, latest processors
 - Give users (or groups) their own HPC clusters
 - Move workloads to different physical platforms
 - Train up new users and administrators in a safe environment
 - Maintain compatibility between many different cloud platforms

Commercial customer public cloud trial



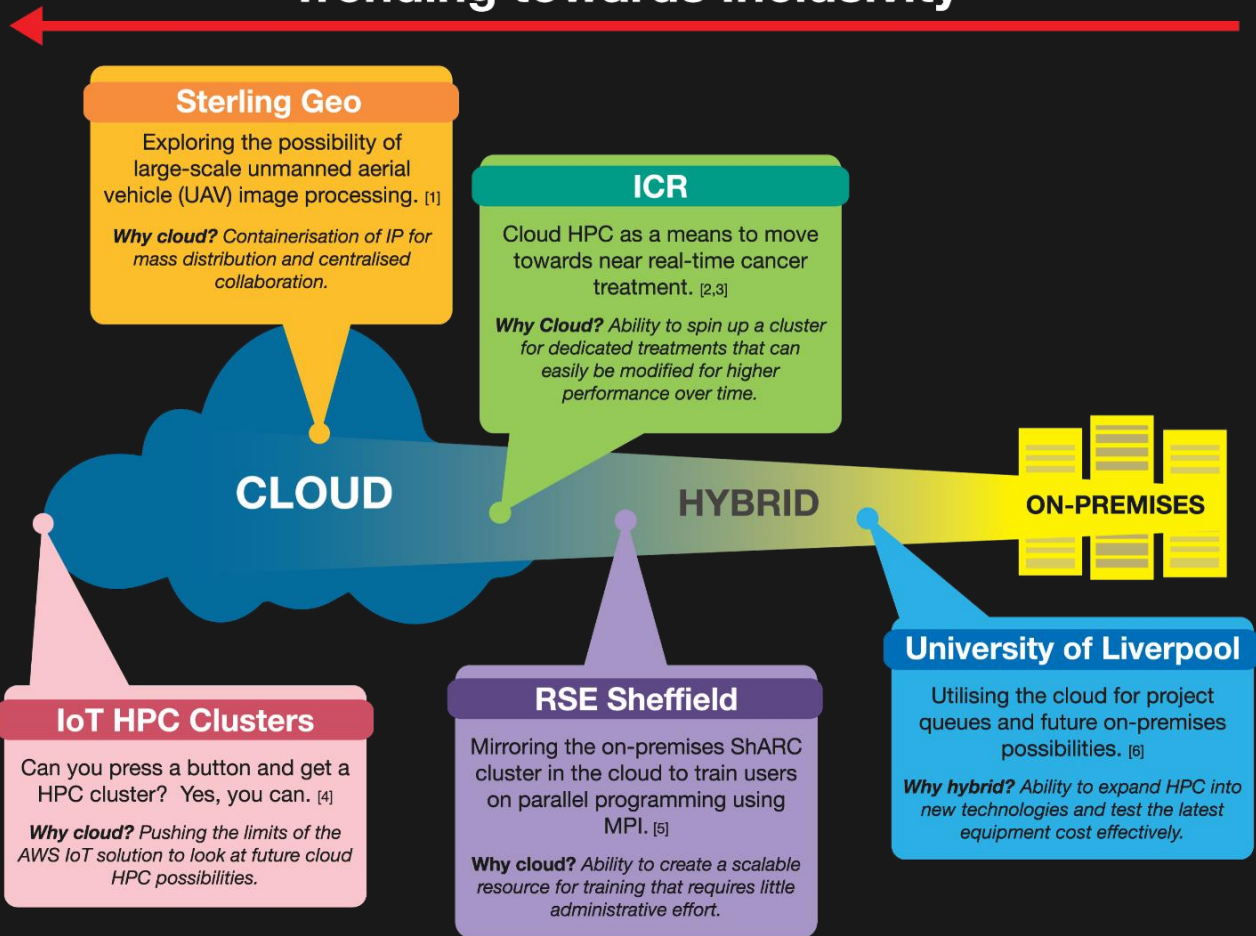
Application X speed-up on AWS



Success stories

- HPC simplicity
- Hybrid solutions
- Cloud-first agility

Trending towards Inclusivity



Your Christmas holiday project



- Try out HPC on public cloud
 1. Sign-up for a free public cloud account on Azure or AWS
 2. Subscribe to the free Alces Flight Community product
 3. Launch a cluster
 4. Install an application
 5. Run a job

Questions?



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