SPARTAN

Performance & Flexibility

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HPC is almost invariably designed as a cluster of computers with a high-speed interconnect.

Cloud computing provides a platform for shared processing resources on demand. The key feature is flexibility.

Spartan has both and can be extended as needed.

Spartan is a new architecture which combines ~~jobs and growth~~ performance and flexibility.

Virtual machines are used for management, login, and i/o nodes.

A relatively small "physical" partition provides the HPC performance, whereas a larger "cloud" partition provides the Cloud flexibility.

Spartan-m and Spartan: 16 core Intel Xeon E312xx @ 2294MHz, 64 GB RAM

Spartan Bare Metal: 12 core Intel(R) Xeon(R) CPU E5-2643 v3 @ 3.40GHz, 294 GB RAM

Spartan Cloud: 16 Intel Xeon E312xx @ 2294MHz, 64 GB RAM

Currently 1024 cloud cores and 256 physical cores - opportunity to scale to 10000+

Edward compute nodes were 16 cores per node, AMD Opteron 6128, 2000 GHz, 32 GB memory

The interconnect between the cloud partitions is 10gb Ethernet; with the added latency of the Neutron core service in OpenStack.

The physical partition uses 25gb/56gb Ethernet with Mellanox SN2700 and SN2100 leaf switches with 100G connections to core. There is Fast CEPH storage from the spine, and multiple 56gb scratch storage nodes from the leaf.

Using Linux version 3.10.x and Red Hat Enterprise Linux Server release 7.2

Consistency in operating system and libraries in the management, login, i/o, physical, and cloud compute nodes maintained through Puppet.

SLURM Workload Manager for resource manager and job scheduler.

EasyBuild is used for software installations; builds from source codes with specified toolchains and dependencies. Automatically generated LMod environment module files.

96 software applications installed.
Configuration tools (autonconf, automake, CMake), Compilers (GCC, Intel), wrappers (OpenMPI), and other programming languages (NASM, Python)

Specialist libraries (FFTW, ATLAS, Blas)

Mathematical and statistical applications (MATLAB, R, Octave)

Life science applications (FreeSurfer, Cufflinks)

Coming very soon: Gaussian, NAMD, Abaqus

Over 15000 jobs have already been run on Spartan

First large scale test was for COMP90024 Cluster and Cloud Computing course in March - almost 10000 MPI jobs run over a single weekend by over 100 users.

No problems!

Physical nodes (TCP/IP): spartan-bm[016-017] 6.12 uSec
Physical nodes (IBoIP): spartan[018-019] 1.17 uSec
Edward: edward[27,34] 19.98 uSec
Cloud nodes: spartan[001-002] 62.98 uSec

I am currently using Spartan to make models of star fields in galaxies along the line of sight to a quasar of interest..... To recreate an accurate picture of the magnified quasar we have to understand/model the star field accurately, which required a large amount of computing power, Spartan has allowed these calculations to be done quickly and efficiently.

- *Anthea King, School of Physics*

Cloudbursting. SLURM has the capability to turn compute nodes on and off on demand.

Co-investment and new architectures.

Sparta is immortal - new nodes can be created and removed as needed. The entire system can change and the service 'Spartan' will be still be present.

This HPC/Cloud chimera architecture will become the standard for such research compute platforms in the future.

It's where great ~~minds~~ architectures collide.