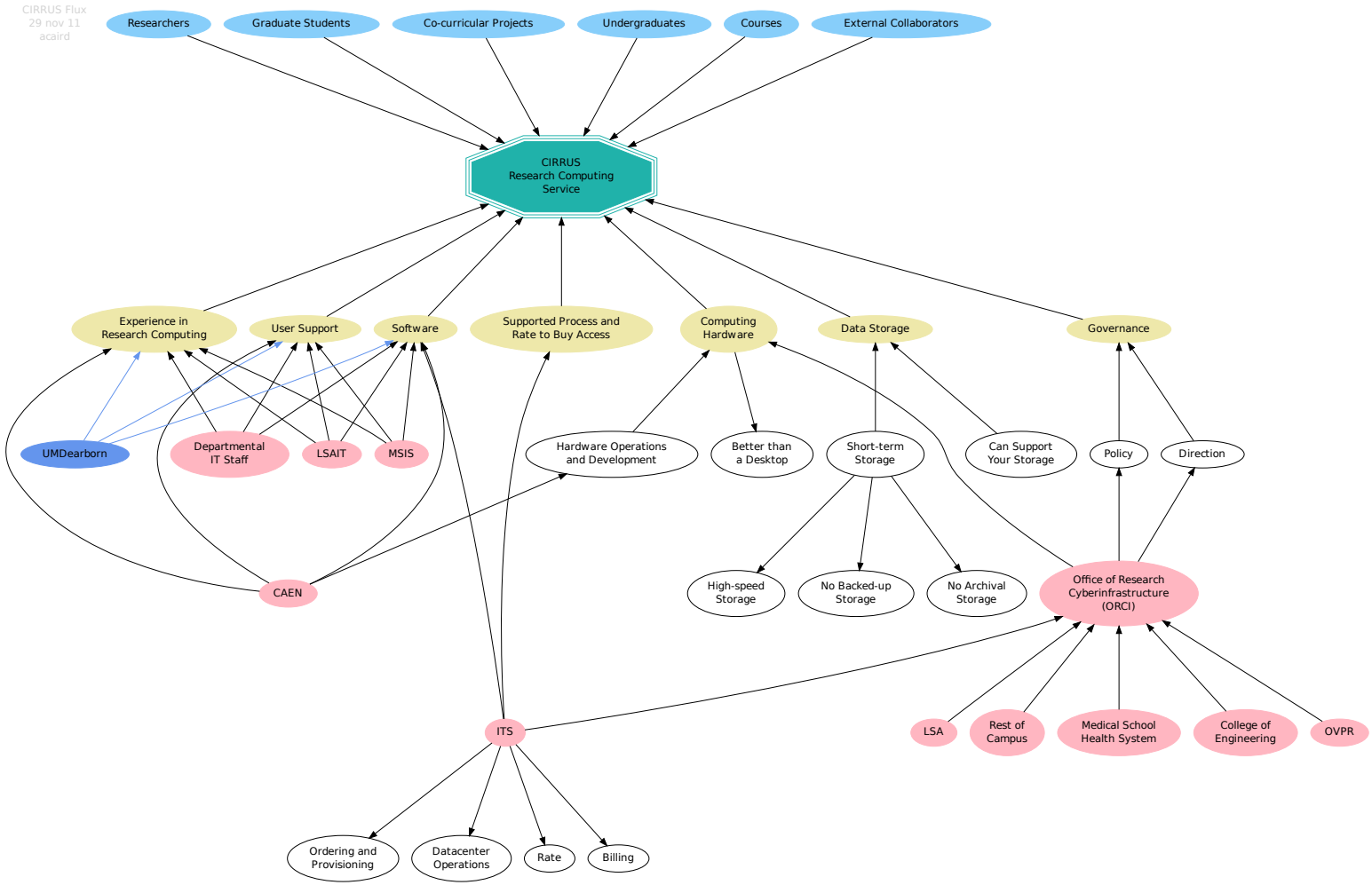
High-Performance Computing at the University of Michigan: CIRRUS Flux

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CIRRUS: Flux

CIRRUS is a coordination of U-M resources:



CIRRUS

Computing and
Information
Resources for
Research as a
Utiliy
Service

We want people to do computing without worrying too much about the computers.

Flux: the concept

The Flux Project endeavors to provide cluster, data-intensive, and next-step computing to U-M researchers.

The Flux Project aggregates demand and fulfills it in an efficient way for you; it is a set of policies for providing HPC:

- cores are allocated in increments of 1, the number of which can be increased or decreased every month
- there is no hardware ownership, everything is allocations from an existing pool of hardware
- the hardware is held as homogeneous as possible: similar CPUs, memory-to-core ratios, networking capability

Flux: the paperwork

The Flux Project is currently based on two-dimensional allocations:

- a number of cores for a number of months

The usage of the Flux Cluster is billed monthly:

- billed for allocation, not usage
- no "roll-over", so all commitments can be honored
- can be changed every month (really, any day during the month)

Flux: the hardware

- 4,000 cores in 339 computers
- Per computer: dual 6-core Intel Xeon X5650 CPUs at 2.67GHz; 48 GB RAM
- Quad Data Rate (QDR) Infiniband per node: 40Gbps, $\sim 4\mu$s latency
- 375 of scratch space :
  4 hosts, 48 CPUs, and 180 hard drives
- 8 NVIDIA M2050 General Purpose Graphics Processing Units (GPUs)
- 10GbE data transfer connection (soon to include U-M Dearborn)



What Flux is good at

A traditional HPC environment, like Flux, is good at computational problems that have certain properties:

- explicitly parallel jobs: many-core MPI programs
- "trivially" parallel jobs: many single-core tasks
- long-running serial jobs: so you can turn off your laptop
- jobs with large data sets: larger than your laptop can hold

What Flux is good at

In addition to being a nice implementation of a traditional HPC environment, Flux has a few other nice properties:

- it is *local*: in network, support, physical, and philosophical senses
- it is dynamic: researchers can start small and scale up and down as their needs or budget dictate

What Flux is being used for

On 25 October 2011, Flux has 72 different research groups using it. Three examples of its use are:

- Center for Radiative Shock Hydrodynamics (CRASH) is improving the ability to do predictive simulations of high energy-density flows
- Dr. Abecasis in Public Health is developing the computational and statistical tools required for understanding human genetic variation, with a particular focus on complex human disease
- Dr. Mebane in Political Science is studying Election Forensics, which aims to develop statistical and computational tools for detecting anomalies and diagnosing fraud in election results

What Flux is not good at

For all its nice properties, Flux is not ideal for everything. Among those are:

- programs or projects with significant graphics requirements
- interactive use
- running non-Linux programs

Flux: Software

- three compilers (Gnu(2), Intel(3), PGI(5)),
- MPI library (OpenMPI ($3\times \sim 4$))
- Commercial parallel debugger (DDT) and profiler (OPT)
- 102 other packages, about 40% commercial, 60% locally compiled

Colleges, Schools, or Departments can add their own software; LSA and the Medical School are doing this today.

The Process

To use Flux, it's best to start by reading `http://www.engin.umich.edu/caen/hpc/planning/` or contacting `flux-support@umich.edu` to talk about the needs and the suitability of Flux.
After that your local Flux Support person will need to know:

- the number of cores in the allocation
- the duration of the allocation in months
- the list of allowed users for the project
- a valid shortcode we can charge each month

Once we have that information it is a matter of hours to make the allocation.

Flux: All you need to know

- **Many** cores, many Terabytes, many Gigabits per second
- **Lots** of software, and more if you want it
- **Excellent** local support from staff in your lab, department, school, college, University
- **Affordable** monthly bills of **$18/core** ($11.20/core until July 2012) $\Rightarrow$ flexibility and control

`flux-support@umich.edu`

`http://www.engin.umich.edu/caen/hpc`