Challenges of Modern HPC

• Support for heterogeneous environments, workflows, development, and data driven needs

• Bare Metal Provisioning
• Virtualization support w/KVM
• Containers
• Integration with Existing Cloud Services
  – Amazon EC2
  – OpenStack Deployments (XSEDE: JetStream)
• Databases
• Web Portals
• Hadoop / Spark
OpenStack

• What is OpenStack?
  – Open source software for creating public and private clouds
  – Abstraction Layer of Physical / Virtual resources
    • Storage
    • Networking
    • Compute
  – IaaS (Infrastructure as a Service) : Orchestration for deploying
    • Virtual Machines
    • Containers
    • Baremetal
  – Community and Industry Success
    • Who uses it?
      – AT&T, PayPal, Ebay, Walmart
    • Who supports it?
      – Intel, RedHat, SuSE, Ubuntu, Rackspace
    • Approximately 2000 active developers
OpenStack

- Why OpenStack?
  - OpenStack services support standalone deployment
    - Sahara : Hadoop
    - Trove : Database
    - Magnum : Containers (Docker/Kubernetes)
    - Ironic : Baremetal Deployment
      - Current Boot Method of Bridges
    - Nova KVM : Virtual Machines
  - Rapidly changing and feature rich
    - HPC community inside OpenStack
  - REST API, integration with Slurm
    - Dedicated resource requests for VMs/Containers
Virtual Machines

- **OpenStack w/KVM**
  - Support existing research infrastructures
    - VM repository for common science workflows
    - Repeatable, scalable, environments on demand
  - Support custom environments
    - User supplies existing VMs
    - Allows scaling without rebuilding environment/infrastructure
  - User Managed vs PSC Managed
    - Advanced users utilize OpenStack Dashboard
      - Full control over VM
    - Standard VMs handled by PSC staff
Containers

- OpenStack w/Docker Integration
  - Support existing Docker workflows
    - Facilitate large scale Docker deployments
  - Performance benefits over VM
    - Closer to metal: No hypervisor overhead
    - OmniPath w/out needing SR-IOV
  - Enable non traditional HPC users
    - Scale user supplied environment
Application Support

• Primary Goal is Application Support

• Web Portals
  – Quick turnaround for httpd deployment
  – Facilitate non traditional HPC access
    • Community accounts

• Databases
  – Spin up templates MySQL, Postgres environments
  – On demand needs w/persistent storage
Comments? Questions?