IBU HPC Infrastructure

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HPC = High Performance Computing

Using large amounts of power

- over a short time(hours)(HPC): weather forecast, genetic diagnostic
- over a long time(months)(High Throughput Computing, HTC): Astrophysics, climate research
- grid computing: Particle Physics at CERN

History

- Cray-1, 1976, 160 MFLOPS | Smartphone, 2013: 1GFLOPS
- IBM BlueGene/P, 2007, 23 TFLOPS, 65'537 CPUs
- Cray, XC50, 2017, 27 PFLOPS, 133'716 CPUs(Piz Daint, CSCS)
- Ubelix, 6300 CPUs
- IBU Cluster, 1888 CPUs
- My Laptop, 8 CPUs

Features

Operating System Operating systems used on top 500 supercomputers(wikipedia): gradually turn from Unix to Linux, very rare K.A./Ver., BSD, Windows, Mac.

Queuing System

- Concurrency on resources(CPUs, RAM) for users and job
- Optimal usage of resources

Storage

- Large capacites
  - 1 Hard Disk: 16TB
  - Piz Dint: 8'000 TB
  - Ubelix: 3'000 TB
  - IBU: 1'000 TB
- High number of files
  - typically: 100's of millions of files

Network

- Nodes Interconnect
  - Typical: 10-56 Gbit/s
  - Network type: TCP/IP or infiniband
- Outbound connection
  - Typical: 10 GBit/s

Internal Network

- IBU 40GBit/s switch

Chanllenges

- Electrical Power
  - Piz Daint: 3MW
  - IBU: 15kW
  - My Laptop: 60W
  - City of Bern: 114MW
- Cooling
- Data flow
  - IBU Cluster: 1PB Data
  - Uplink: 10 GBit/s (10-50days to transfer)

Services

Rschiny, Sequenceserver, BugFRI, openBIS, Galaxy, Gitlab, Rstudio, IBU Cloud, openProjects, Proxmox VMs

IBU HPC Linux Cluster

- **Head node = entry point**
  - ssh binfservms01.unibe.ch
- Cent OS 7
  - 2 * 6 cores
  - 64 GB RAM
  - 1 TB/home
  - 10 Gbit/s Network uplink

Data Storage

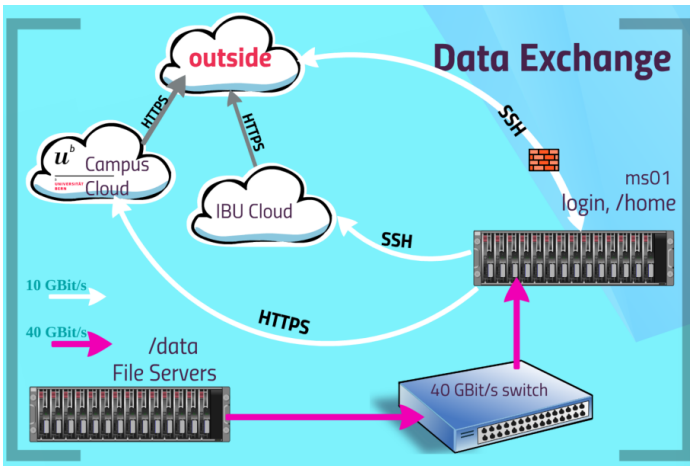
- Total active ~ 400 TB
  - /home/*username* -> /home 1 TB ms01
  - /data/projects/pnnn_abcd -> /data 600 TB fs07
  - /data/users/username -> /data 600 TB fs07
  - /scratch
    - directory local to each node
    - during job excution: `$SCRATCH`
    - /scratch/172007
    - deleted after job completion

Backup

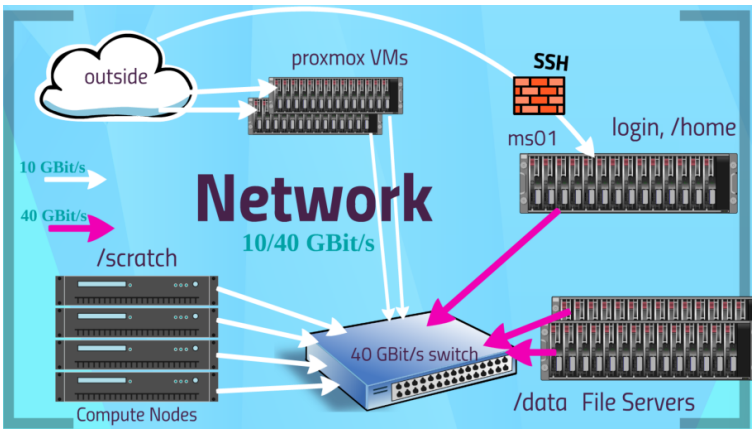
outside <-> von Roll <-> Vetsuisse

- von Roll
  - IBU HPC Cluster
  - Ubelix
  - Research storage
- Vetsuisse
  - Sequencers
  - Ingestion servers
  - Backup server

Data Exchange



Network



Compute nodes

binfservas[01-34]: 32 servers, 2048 cores

- `clusterstate.sh`

nodes	#cores	RAM	/scratch
as01-02	80	512G	8TB
as03	80	2T	11TB
as06	32	256G	5TB
as07-10	16	256G	7TB
as11-14	24	256G	11TB
as15-18	28	256G	7TB
as19-26	40	392G	7-9TB
as27-30	128	512G	9TB
as31-34	128	512G	3TB

SSH

Secure channel over an unsercured network

clinet <-> internet <-> server

- confidentiality

- intergrity
- authentication

Crytography

Symmetric cryptography Goal: establish a secured channel => confidentiality + integrity

Needs a Shared Secret: key => needs a Key Exchange Algorithm

Key Exchange Algorithm Diffe-Hellman

Asymmetric cryptography public/private keys pair User authentication

Server authentication: same principle, reverse sides

SSH Uses

- interactive sessions (shell)
- commands execution on server
- data transfer (scp, sftp)
- port forwarding

Take home

- protect your ssh private key (passphrase)
- use /scratch whenever possible
- beware of small files on /projects, /home
- organize backups
- ibu-best-practices