Introduction to
PDC's environment

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PDC

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PDC Center for
High Performance Computing

Outline

- Ferlin

- How to login

- Where to store files

- How to compile and run a program

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Clusters at PDC

- Ekman

- Ferlin

- Povel

- Ellen

- Lindgren

- See `http://www.pdc.kth.se/`
  `resources/computers`

Ferlin

- 672 Compute nodes

- 8 nodes for login, scheduling and management

- Two types of nodes (A-nodes and K-nodes)

- K-nodes have 8 cores, 16 GB of RAM per node

- A-nodes have 8 cores, 8 GB of RAM per node

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Cluster Nodes

- Login nodes — don't run jobs here!

- Interactive nodes — for test runs; alone or shared among users

- Dedicated nodes (compute nodes) — for running final programs

Kerberos

Now this Cerberus had three heads of dogs, the tail of a dragon, and on his back the heads of all sorts of snakes.

- PDC uses **ssh together with kerberos for login**.

- Kerberos — system for **authenticating users and services on a network**.

- **Kerberos server**, trusted by users and services.

- A **Kerberos principal** (*username@NADA.KTH.SE*) is a user's or service's username for a certain **Kerberos realm** (*NADA.KTH.SE*).

Login from any computer

- You can reach PDC from any computer and network!

- The **Kerberos implementation Heimdal** can be installed on most operating systems (Mac, Windows, Linux)

- An SSH command that knows **GSSAPI key-exchange** can forward Kerberos tickets

- Names of the commands depend on your operating system!

- Follow the instructions for your operating system: `http://www.pdc.kth.se/resources/software/login-1`

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Login Set up on Mac

- You can reach PDC from any computer and network!

- The **Kerberos implementation Heimdal** is already installed on Mac

- ssh already knows how to forward kerberos tickets

- Copy ssh config file and krb5.conf files according to instructions at:

- Follow the instructions for your operating system: `http://www.pdc.kth.se/resources/software/login-1/macintosh`

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Login Set up on Linux

- You can reach PDC from any computer and network!

- Install **Kerberos implementation Heimdal** for your version of Linux

- Install ssh that can forward kerberos tickets

- Copy ssh config file and krb5.conf files according to instructions at:

- `http://www.pdc.kth.se/resources/software/login-1/ linux/copy_of_index_html`

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Login Set up on Windows

- You can reach PDC from any computer and network!

- Install Open source Cygwin or SecureCRT

- Trail version of secureCRT can be downloaded from: `http://www.vandyke.com/download/securecrt/download.html`

- Follow the instructions at:

- `http://www.pdc.kth.se/resources/software/login-1/windows/`

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Kerberos Commands

- `kinit` — proves your identity

- `klist` — list your Kerberos tickets

- `kdestroy` — destroy your Kerberos ticket file

- `kpasswd` — change your Kerberos password

  `kinit -f -l 7d username@NADA.KTH.SE`

  `klist -Tf`

```
Credentials cache : FILE:/tmp/krb5cc_500
        Principal: username@NADA.KTH.SE
   Issued           Expires    Flags  Principal
Mar 25 09:45 Mar 25 19:45 FI   krbtgt/NADA.KTH.SE@NADA.KTH.SE
Mar 25 09:45 Mar 25 19:45      afs/pdc.kth.se@NADA.KTH.SE
```

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Login using Kerberos tickets

- Get a **forwardable** Kerberos ticket on your **local system**:

  `kinit -f -l 7d username@NADA.KTH.SE`

- **Forward** your ticket via ssh:

  `ssh username@ferlin.pdc.kth.se`

- The prompt changes when logged in. Check your tickets on the **remote system**:

  `klist -Tf`

- You have reached the login node

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Login to Interactive Nodes

- Login to Ferlin as shown in previous slide

- Find out which are interactive nodes on Ferlin:
  ```
  module add easy
  spusage | grep interactive
  ```

- You will get a list of interactive nodes.

- Open a new terminal and login to one of the nodes from the list e.g.:
  ```
  ssh username@k09n44.pdc.kth.se
  ```

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File Systems

- **scratch** - node local, temporary

- **AFS** - home directories accessible from anywhere, with backup

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AFS

- Your **Home Directory** - Your home directory is located in AFS.

- When you login you arrive in your AFS home directory.

- The path to your PDC AFS home directory is /afs/pdc.kth.se/home/u/user

- Some pre-existing files and folders to keep: **.bashrc .forward Public Private . . .**

- Oldfiles contain your home directory, as it was yesterday, i.e. a backup.

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Modules

- Modification of the user's environment; handles `PATH`, `MANPATH` ...

  `module avail` - show available modules

  `module show` *modulename* - Display information about modulename

  `module load` *modulename*

  `module list` - Show loaded modules

- Common PDC modules are: `easy`, `afsws` and `heimdal`.

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How to run

- Interactive Jobs

- Batch Jobs

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Running a Serial Job

- Get a Kerberos ticket on your local computer

  `kinit -f -l 7d username@NADA.KTH.SE`

- Login on one of the *interactive* node on Ferlin as shown on slide 13

- Go to the directory where your programs reside

- Compile:

  `gfortran hello_serial.f90 -o hello_serial_f90`

  `gcc hello_serial.c -o hello_serial_c`

- Run:

  `./hello_serial_f90`

  `./hello_serial_c`

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Running an MPI job

- Get Kerberos tickets on your local computer (using kinit)

- Login to Ferlin (using ssh command)

- Find which are interactive nodes

- Login to one of the interactive nodes

- Go to the directory where your programs reside
  ```
  mpif90 hello_mpi.f90 -o hello_mpi_f90
  mpicc hello_mpi.c -o hello_mpi_c
  ```

- Run:
  ```
  mpirun -np 8 -machinefile $SP_HOSTFILE hello_mpi_f90
  mpirun -np 8 -machinefile $SP_HOSTFILE hello_mpi_c
  ```

- For more information on how to run your jobs, please visit:

  ```
  http://www.pdc.kth.se/resources/computers/ferlin/
  how-to
  ```

Common Mistakes

- Please do not run your jobs on the Login Node.

- Make sure your tickets are long enough to run your job and copy your output.

- Do not forget to add the required module when you login.

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When does my job start on Dedicated Nodes

- Many users continuously submit jobs to Ferlin

- Each job needs a certain **time** and a number of **nodes/cores** to run

- The **queue system (scheduler)** keeps track of the submitted jobs and when, and where, each job can run on the cluster

- Every user belongs to at least one **time allocation** on a cluster. You belong to the time allocation **edu12.DN2264**

- A time allocation states **how many node hours per month you have on a specific cluster**.

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Finding Information

- `man`, `--help`, `-h`, `apropos` ...

- `http://www.pdc.kth.se/education/tutorials/summer-school`

- Flash News

- Mailinglists

- Course assistants

- `support@pdc.kth.se`

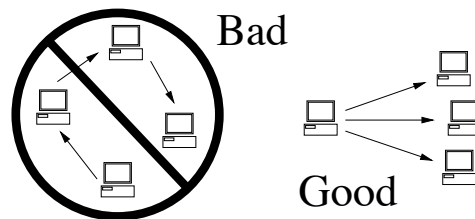**PDC Center for
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Important!

REMEMBER! You are NOT allowed to write your password on any computer that you are remotely connected to!!!. If you expose your password you endanger not only your own work, you are putting all other cluster users at risk.

- Once you have your **local Kerberos ticket** you never need to type your password again!

- Get **forwardable** Kerberos tickets (pass the **-f** flag to `kinit`).

- **Kerberos enabled software** knows to forward/use local Kerberos tickets for remote authentication.

- **Forward your forwardable tickets when opening a remote connection**.

Bad

Good

Thank you for listening!