Setting up STAR software and environment at a remote site

Petr Chaloupka

Nuclear Physics Institute

Academy of Sciences of the Czech Republic

STAR collaboration meeting, Hefei, China

03/01/07

Outline

Remote vs local work discussion

Setup of local STAR framework

Local MySQL mirror

Summary

Working remotely-pros

Available sites:

RCAS

16 interactive nodes

403 computing nodes , 1002 CPUs

disk space   225TB

HPSS storage   7PB

scheduler   LSF,Condor

PDSF

8 interactive nodes: pdsf.nersc.gov, pc260[2-9].nersc.gov

275 computing nodes: pc[0902 – 2834].nersc.gov

disk space: 135 TB

scheduler   SGE

Advantages:

- large number of possibly used nodes

- hardware taken care of

- software kept up to date

- all data are in the place and accessible via catalog

- available scheduler

- great for big batch jobs

Working remotely-cons

- hard for interactive work

  vi, emacs -nw

- Internet connection from outside often not very good

- Often overloaded

  takes time for scheduled jobs to start running

  impossible to run quickly high priority jobs – even if they are small

- Small available user disk space

- Need to transfer results to local computer – slow graphics over ssh

- **Inconvenient for continuous editing and rerunning**

Working locally

Can we use our local computing power for.....?

  Use STAR libraries

  Code development - edit and compile STAR code

  Running StChain, root4star, staf ...

  Working with different version ...old, new, dev.

If so, what do we need in terms of:

  Hardware equipment

  Time and complication to set up

  Level of maintenance

  What are the options

Options for local computing

Local editing:

editing scrips and code locally over AFS
compile and run on RCAS
comfortable, simple .... **NOT really local computing**

STAR libraries over AFS:

root4star and STAR libraries are accessible over AFS
code runs on local machine
compilation of your own code only
this options is possible to use at PDSF

This is what I will talk
about as local computing.

True local copy of STAR software:

local copy of STAR sources
everything is locally compiled
independent of RCAS

To begin with

Two main things necessary for a remote site:

access to STAR libraries and software
- · usually via AFS
- · can by bypassed by logging to rcas by ssh
    – ugly, not recommended
- · CVS - to access code in the repository

    set $CVSROOT to /afs/rhic.bnl.gov/star/packages/repository
    must use the same local username as for AFS

setup STAR environment on the local computer
- · Set up environment variables during login

AFS

Distributed file system over TCP/IP, based on client/server model.

Sharing of files over the Internet.
- Provides security- authentication and Access Control List.
- Caching - less vulnerable to Internet problems.
- All STAR files in RHIC cell: /afs/rhic.bnl.gov

When setting up the site.
- Free software from `www.openafs.org`
- All that is needed is the **AFS client only**.
- AFS module is loaded into Linux kernel.
- File `/usr/vice/etc/ThisCell` has to contain `rhic.bnl.gov`.
- In file `/usr/vice/etc/CellServDB` is list of available AFS cell servers. This list has to contain the `rhic.bnl.gov` cell. If RHIC servers change this file has to be updated! It can be copied from any rcas machine.
- Configure your cache in `/usr/vice/etc/cacheinfo`. This influences the performance.
- Make sure your AFS can see through your firewall.

Environment setup

The login environment is set by login scripts `.login, .cshrc`

They can be downloaded from RCAS:

```
cp /afs/rhic.bnl.gov/star/group/templates/cshrc ~/.cshrc
cp /afs/rhic.bnl.gov/star/group/templates/login ~/.login
```

It's preferable to make own copy of group directory

Check out from CVS: `cvs co group`

Make your `$GROUP_DIR` point to it's new location.

It's possible, now, to freely change the system variables if needed. How is described later...
The most important variables:

`AFS_RHIC` : top rhic directory path [default = /afs/rhic.bnl.gov]

`OPTSTAR` : Base directory for updates of /usr/XXX or /usr/local/XXX [default = either /opt/star if exists or $XOPTSTAR]. The entire tree $XOPTSTAR may be installed on your local cluster.

`STAR_SYS` : architecture (i386_linux2, sun4x_56, i386_sl302 ...)

More informations at: `www.star.bnl.gov/STAR/comp/train/tut/EnvSetup.html`

Running with AFS libraries

If the environment setup is done according to the previous slide the result will be `$AFS_RHIC` set to /afs/rhic.bnl.gov. The STAR code will be accessible via AFS.

the good:

Code runs on your computer
Very simple
Can be done on a single computer
No need for maintenance

the bad:

Loads libraries over AFS – only for the first time then it's cached,

Slow if the Internet connection not fast enough.

Doomed if AFS is down.

System must be perfectly compatible with RCAS supported distribution!

-The system has to have proper AFS sysname in /etc/sysconfig/afs .

-No guarantee that code compiled on rcas will run on your computer.

What is the "local installation"

STAR software, which is normally in shared AFS directory `/afs/rhic.bnl.gov/star` is copied on local disk: `/localSTAR` – for example.

STAR environment
    Using local copy of STAR login and setup scripts:
        `/localSTAR/star/group`
    Evironment variables are altered during login to point to local installation:
        `$AFS_RHIC` points to `/localSTAR`

Physical copy of STAR software on local disk
    This includes:

root libraries:	`/localSTAR/star/ROOT`
STAR libs:	`/localSTAR/star/packages/SL*../dev,/pro`
Optional libraries:	`/localSTAR/opt`

All code is compiled locally

Hardware requirements

Based on the experience from setup done in Prague.

Full local setup – **not worth doing on one computer**.

Cluster of computers with the same system installation.

Prague (example):
    part of "Golias" computing center – mainly used by Alice and Atlas
    advantage   - low hardware maintenance
    disadvantage - almost no choice over installed software

    4x double Opteron 244, 2GB RAM
    shared NFS disk space on the farm
    only one nod with AFS software
    100 Mbit/s connection outside

full local compilation is a must

From our experience: 8 CPUs on a farm that can be used any time is worth the installation.

Installation - prelude

Where to install - on a shared disk
only one installation for the whole cluster

a) make local AFS server – NOT recommended
   advantage –   users can use afs clients to access their
                  code and disadvantaged
   could be quite unstable,
   not worth the trouble

b) on NFS disk - preferred
   stable
   easier for maintenance
   usually available on most of the clusters

Installation can be done from one computer with access to AFS and distributed to the whole cluster via NFS.

Installation – dir structure

example: we decide to make the local setup into `/localSTAR`

create following structure of subdirectories - this is where the source code goes:

```
/localSTAR/opt/star
/localSTAR/star/packages
            /group      ........ this will be your GROUP_DIR
            /ROOT
```

Setup the basic users environment

- just like when running over AFS

```
cp /afs/rhic.bnl.gov/star/group/templates/cshrc ~/.cshrc

cp /afs/rhic.bnl.gov/star/group/templates/login ~/.login
```

Set GROUP_PATH

Go to ~/.login and ~/.cshrc and change GROUP_DIR to

setenv GROUP_DIR "/localSTAR/group"

apply the changes

source .login

Installation – setup scripts

Now retrieve the your own **copy of the `$GROUP_DIR` from CVS**:

    don't forget to set $CVSROOT to `/afs/rhic.bnl.gov/star/packages/repository`

    `cd /localSTAR/star/; cvs co group`

In `$GROUP_DIR` two **scripts** are made especially **for remote sites** to put their **pre and post initialization** code into:

    `site_pre_setup.csh , site_post_setup.csh`

therefore:

    `cd $GROUP_DIR; touch site_pre_setup.csh`
    `echo "setenv CVSROOT /afs/rhic.bnl.gov/star/packages/repository"`
        `> site_pre_setup.csh`
    `echo "setenv AFS_RHIC /localSTAR" >> site_pre_setup.csh`

Now the environment is set. When you log back next time you should have the CVS set for rcas repository and main STAR path pointing to your local disk.

Now it's time to load the libraries .....

Libraries

Load from RCAS **sources of libraries** into corresponding local directories

/afs/rhic.bnl.gov/star/packages/dev ...new .. pro ...whichever you need

CERNlib needs to be installed

for example into /localCERN

edit $GROUP_DIR/site_pre_setup.csh

add line: setenv CERN /localCERN

Install **additional necessary software**:

read informations at

/afs/rhic.bnl.gov/star/common/AAREADME

see what you're missing(like qt, mysql-client,valgrind ..) and install it
    – you will need to compile
this goes to /localSTAR/opt/star

You need all of this to successfully compile STAR code!

Now it's time to compile.......

Compilation

ROOT libraries

Need to be downloaded from CVS and compiled

Just follow info at
`http://www.star.bnl.gov/STAR/comp/root/building_root.html`
and install ROOT version that are need for your version of libraries
– see rcas login message for a list of ROOT versions
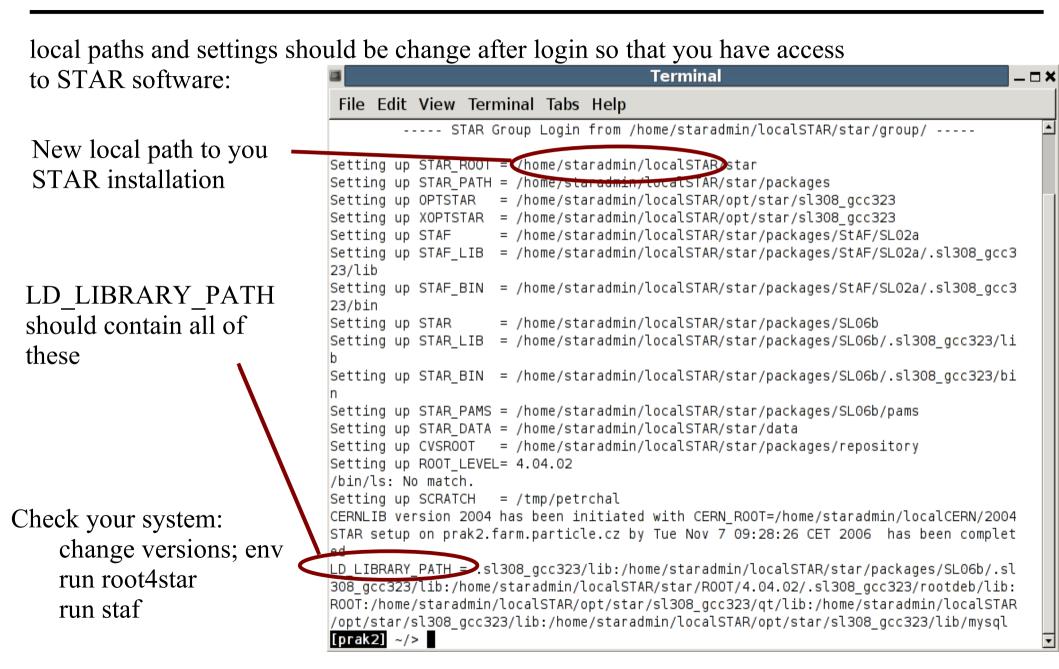you may need to modify or download from rcas
$ROOT/"version"/etc/system.rootrc

Compile the **STAR libraries**
```
starver "version"
cd $STAR
cons
```

do this for all versions

DONE!!

DONE – check it

local paths and settings should be change after login so that you have access to STAR software:

New local path to you
STAR installation

LD_LIBRARY_PATH
should contain all of
these

Check your system:
    change versions; env
    run root4star
    run staf


```
----- STAR Group Login from /home/staradmin/localSTAR/star/group/ -----
Setting up STAR_ROOT = /home/staradmin/localSTAR/star
Setting up STAR_PATH = /home/staradmin/localSTAR/star/packages
Setting up OPTSTAR   = /home/staradmin/localSTAR/opt/star/sl308_gcc323
Setting up XOPTSTAR  = /home/staradmin/localSTAR/opt/star/sl308_gcc323
Setting up STAF      = /home/staradmin/localSTAR/star/packages/StAF/SL02a
Setting up STAF_LIB  = /home/staradmin/localSTAR/star/packages/StAF/SL02a/.sl308_gcc3
23/lib
Setting up STAF_BIN  = /home/staradmin/localSTAR/star/packages/StAF/SL02a/.sl308_gcc3
23/bin
Setting up STAR      = /home/staradmin/localSTAR/star/packages/SL06b
Setting up STAR_LIB  = /home/staradmin/localSTAR/star/packages/SL06b/.sl308_gcc323/li
b
Setting up STAR_BIN  = /home/staradmin/localSTAR/star/packages/SL06b/.sl308_gcc323/bi
n
Setting up STAR_PAMS = /home/staradmin/localSTAR/star/packages/SL06b/pams
Setting up STAR_DATA = /home/staradmin/localSTAR/star/data
Setting up CVSROOT   = /home/staradmin/localSTAR/star/packages/repository
Setting up ROOT_LEVEL= 4.04.02
/bin/ls: No match.
Setting up SCRATCH   = /tmp/petrchal
CERNLIB version 2004 has been initiated with CERN_ROOT=/home/staradmin/localCERN/2004
STAR setup on prak2.farm.particle.cz by Tue Nov 7 09:28:26 CET 2006  has been complet
ed
LD_LIBRARY_PATH =.sl308_gcc323/lib:/home/staradmin/localSTAR/star/packages/SL06b/.sl
308_gcc323/lib:/home/staradmin/localSTAR/star/ROOT/4.04.02/.sl308_gcc323/rootdeb/lib:
ROOT:/home/staradmin/localSTAR/opt/star/sl308_gcc323/qt/lib:/home/staradmin/localSTAR
/opt/star/sl308_gcc323/lib:/home/staradmin/localSTAR/opt/star/sl308_gcc323/lib/mysql
[prak2] ~/>
```

local MySQL database

Why to have a local databese?

Connecting and downloading from database far away takes large fraction of time when running short sessions.

Little comparison:
  Script to simulate 5 SVT events →

  With remote database
  more than 10 minutes.

  With local database
  about 2 minutes.

runing code multiple times:
  no caching – the data are tranfered every time

```
File  Edit  Options  Buffers  Tools  C++  Help

{ //making 5 simulated SVT events
  LoadLibraries();

  StChain *chain  = new StChain("myMainChain");

  //_____
  // GEANT maker
  St_geant_Maker        *geantMk  = new St_geant_Maker("geant");
  char* MainFile = "data/cf1197_05_5940evts.fzd";
  geantMk->SetInputFile(MainFile);

  //_____
   // DB maker
  dbaseMk = new St_db_Maker("db","MySQL:StarDb");
  dbaseMk-> SetDateTime(20021115,000000);

  //_____
  // SVT Db maker
  svtDbMk  = new StSvtDbMaker("svtDb");

  //_____
  // Simulation Maker
  simMkr = new StSvtSimulationMaker("SvtSimu");

  Int_t iInit = chain->Init();
  if (iInit) chain->Fatal(iInit,"on init");

  //
  // Event loop - 5 events
  //
  nevent=5;
  int istat=0,i=1;
  EventLoop: if (i <= nevents && istat!=2)
  {
    chain->Clear();
    istat=chain->Make(i);

    goto EventLoop;
  }
  chain->Finish();
}
```

MySQL server

Contact M. DePhillips – person in charge of databases

MySQL - software under GNU GPL license

Get correct version from `www.mysql.com` - must be the same   version
as in BNL.

Or get it from your distribution package if available

Note when installing:

The server must be running as slave to the BNL server

=> automatic data update.

Has to be set to use GMT time.

To check status: log into mysql database and type "`show slave status`"

Server lookup

`~/dbServers.xml` contains the address of your new local server.

the original bnl server can be used as a second in the list

If local server is down, programs will automatically access other servers.

Database heartbeat

functionality of the slave mirror can be checked at:
http://online.star.bnl.gov/admin/slave.php

look at the database list – you can use any of the mirrors in your list
 ~/dbServers.xml

Host	Server ID	Last Good Date	Last Good Bin Position	File	Ver.
rhic23.physics.wayne.edu	131183316	2006-11-7 10:10:04	461887491	robinson-bin.000056	4.1.14
se51-52.jinr.ru	880563316	2005-11-2 10:00:03	10726223	robinson-bin.000050	4.1.14
pdsfdb08.nersc.gov	128552431	2006-11-7 10:10:04	461887491	robinson-bin.000056	4.1.14
db01.star.bnl.gov	880483316	2006-11-7 10:10:04	461887491	robinson-bin.000056	4.1.14
db02.star.bnl.gov	880493316	2006-11-7 10:10:04	461887491	robinson-bin.000056	4.1.14
db03.star.bnl.gov	880503316	2006-11-7 10:10:04	461887491	robinson-bin.000056	4.1.14
db04.star.bnl.gov	880513316	2006-11-7 10:10:04	461887491	robinson-bin.000056	4.1.14
db05.star.bnl.gov	880523316	2006-11-7 10:10:04	461887491	robinson-bin.000056	4.1.14
db06.star.bnl.gov	880533316	2006-11-7 10:10:04	461887491	robinson-bin.000056	4.1.14
db07.star.bnl.gov	880543316	2006-11-7 10:10:04	461887491	robinson-bin.000056	4.1.14
stardb.ujf.cas.cz	880583316	2006-11-7 10:10:04	461887491	robinson-bin.000056	4.0.18
stars.if.usp.br	880573316	2006-11-7 10:10:04	461887491	robinson-bin.000056	4.0.20
star1.lns.mit.edu	880553316	2006-11-7 10:10:04	461887491	robinson-bin.000056	4.1.21
rhilxs.ph.bham.ac.uk	880633316	2006-11-7 10:10:04	461887491	robinson-bin.000056	4.1.22
stardb.tamu.edu	880623316	2006-11-7 10:10:04	461887491	robinson-bin.000056	4.1.19
db08.star.bnl.gov	880613316	2006-11-7 10:10:04	461887491	robinson-bin.000056	4.1.20
rhig.physics.yale.edu	880603316	2006-11-7 10:10:04	461887491	robinson-bin.000056	4.1.12

Where to go for help and informations

Main SOFI and help page

`www.star.bnl.gov/STAR/comp/sofi/`   software infrastructure

`.../STAR/comp/train/`   trainings and tutorials

Hypernews and mailing list

http://www.star.bnl.gov/central/lists/

Offsite facilities hypernews

- the best source for asking questions and problem solving

http://www.star.bnl.gov/HyperNews-star/get/offsites.html

Environment setup

http://www.star.bnl.gov/STAR/comp/train/tut/EnvSetup.html

ROOT libraries compilation – very useful

http://www.star.bnl.gov/STAR/comp/root/building_root.html

Database informations

http://www.star.bnl.gov/STAR/comp/db/

Conclusions

Installation of the STAR software framework is possible on local computer cluster within a week-time; including local database mirror.
Hardest part (in my opinion) being the ../star/opt libraries.

pros

- Local computers can be comfortably used for computing within STAR software frame work.

- Quickly accessible database with almost no required maintenance.

- Significant increase in work speed and efficiency.

- Insensitivity to Internet speed and quality fluctuations.

cons

- Higher maintenance

- Libraries may not be completely up to date.

- Need of updating - can be automatized using cron.

- Need to transfer data to the local storage