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23 JUL 2015

KIAF TUTORIAL

TUTORIAL OUTLINE

- Part I
  - Introduction to PROOF
- Part II
  - KIAF Basics
- Part III
  - ALICE-specific things

AIM OF THE TUTORIAL

- The aim is twofold
  - Introduce the concept and basic of PROOF to you
  - Teach you where to find when you need something
- Documentation always helps
- Personal support is available at

sahn@kisti.re.kr

(or sang.un.ahn@cern.ch)

(or realapyo@gmail.com)

PART I

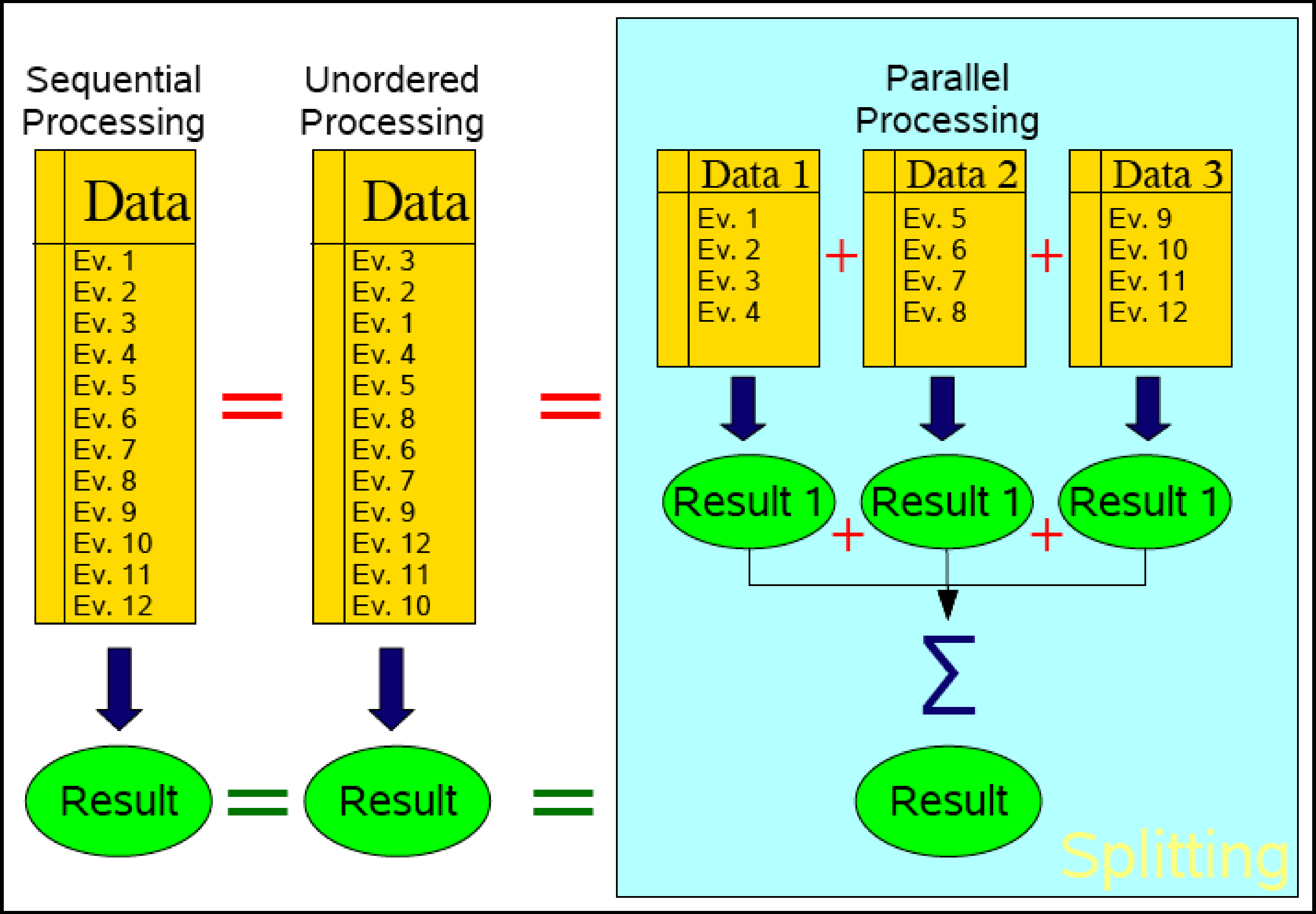
PROOF INTRODUCTION

PROOF

- **P**arallel **ROO**T **F**acility
  - Parallel coordination of distributed ROOT sessions
  - A software that enables parallel processing of data analysis task either on desktop/laptop or on a localhost or a cluster
- ROOT?
  - Popular and basic tool coded in C/C++ for data analysis in science
  - For more information, visit http://root.cern.ch
- Parallel?

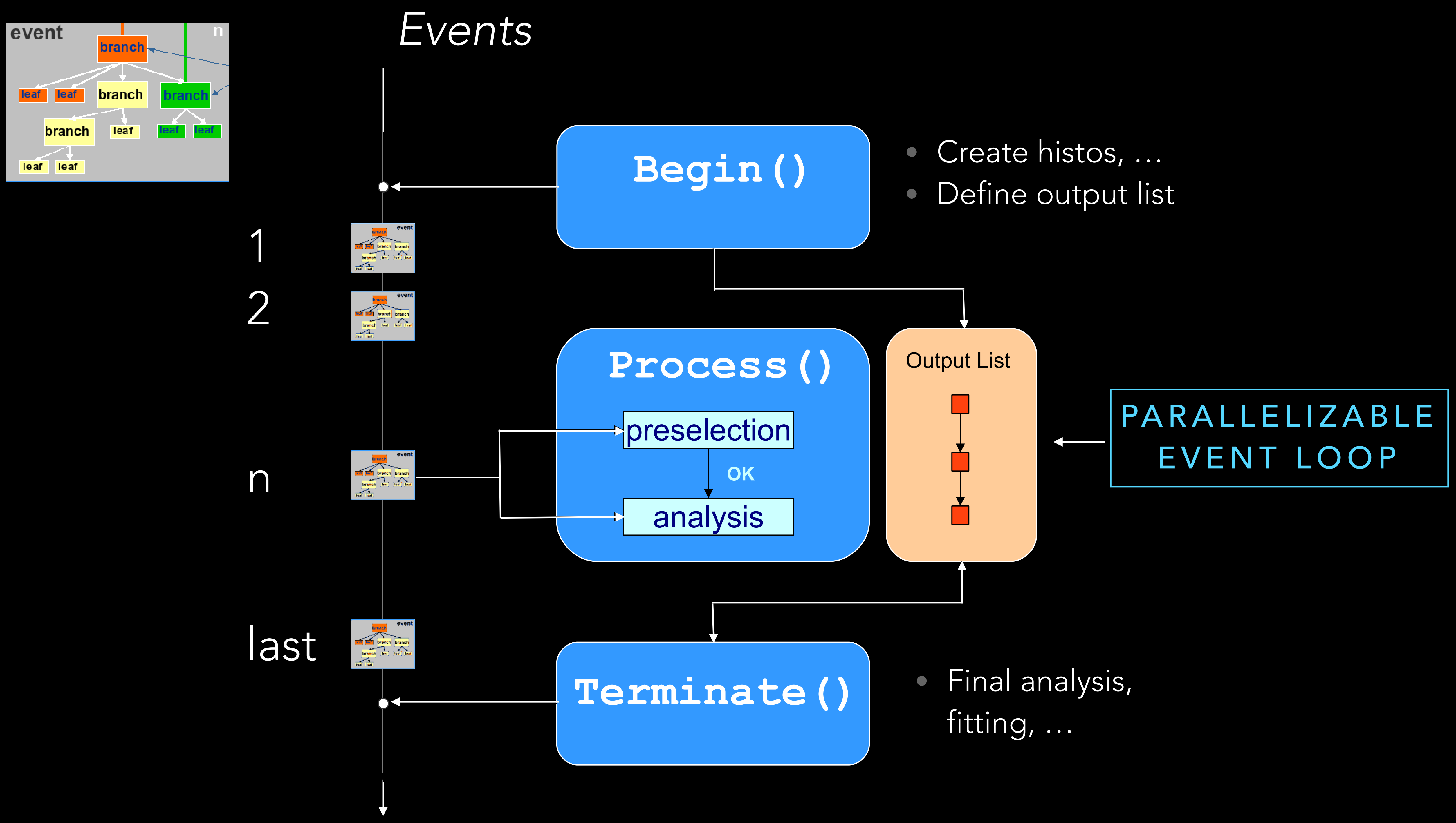
PARALLELISM-IDEAL

Typically **embarrassingly parallel tasks**: just split to get ideal parallel speedup



EVENT-LEVEL PARALLELISM:

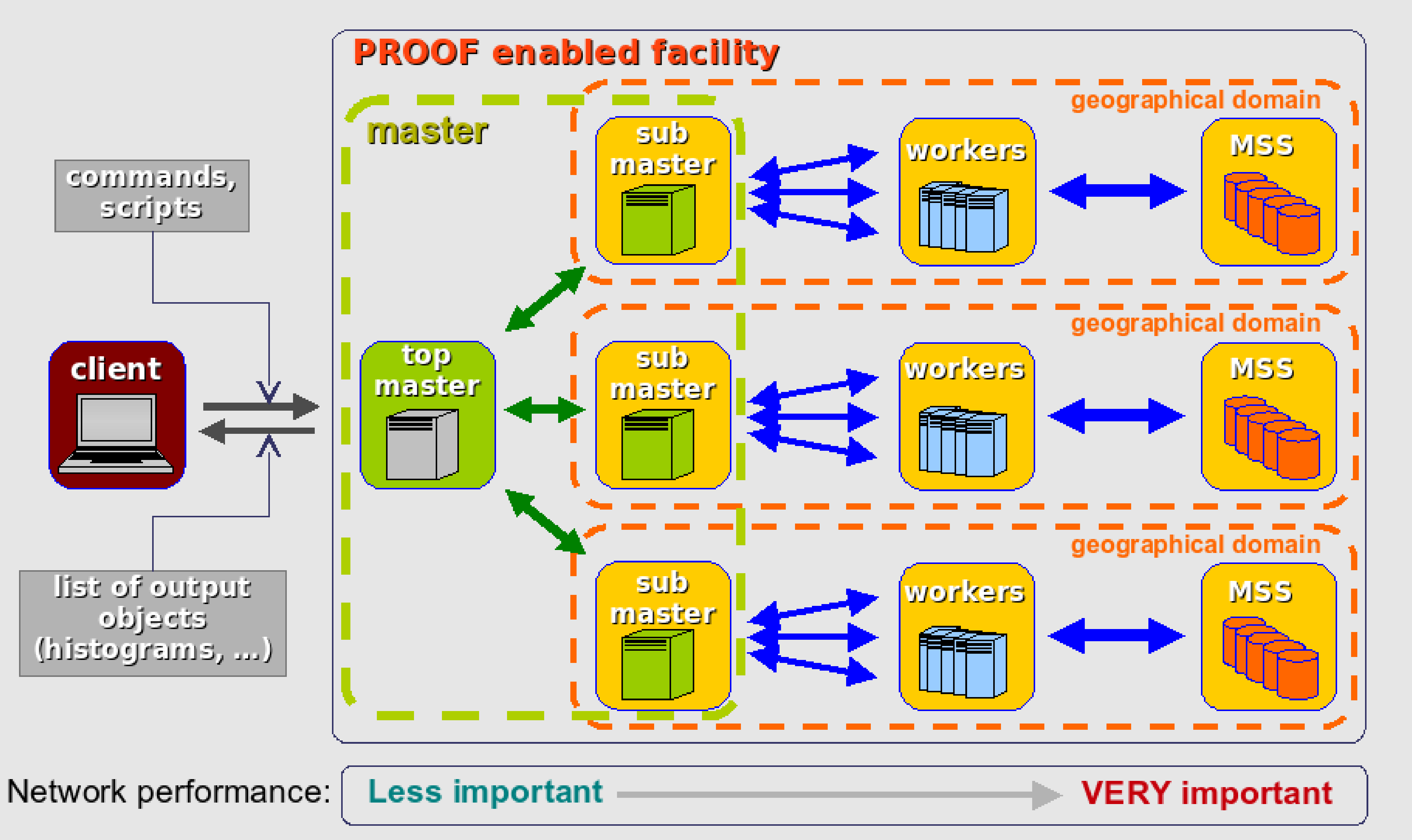
TSelector framework



- Create histos, …
- Define output list

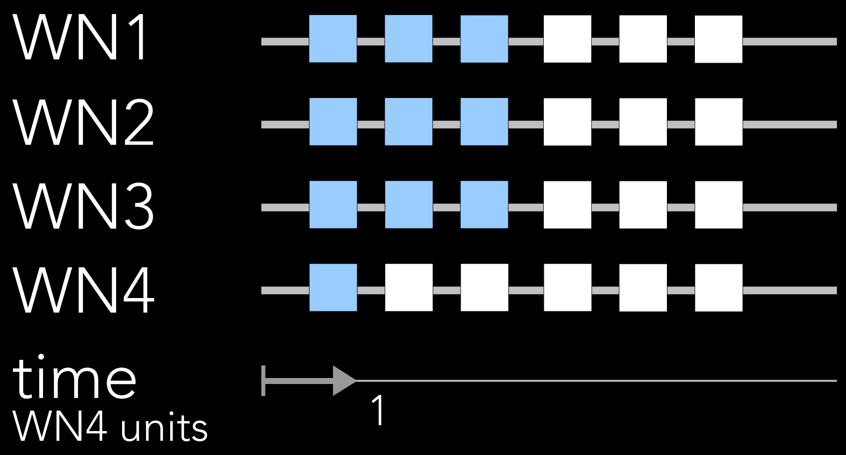
- Final analysis, fitting, …

PROOF ARCHITECTURE



LOAD BALANCING: STATIC

Example: 24 files on 4 worker nodes, one under-forming



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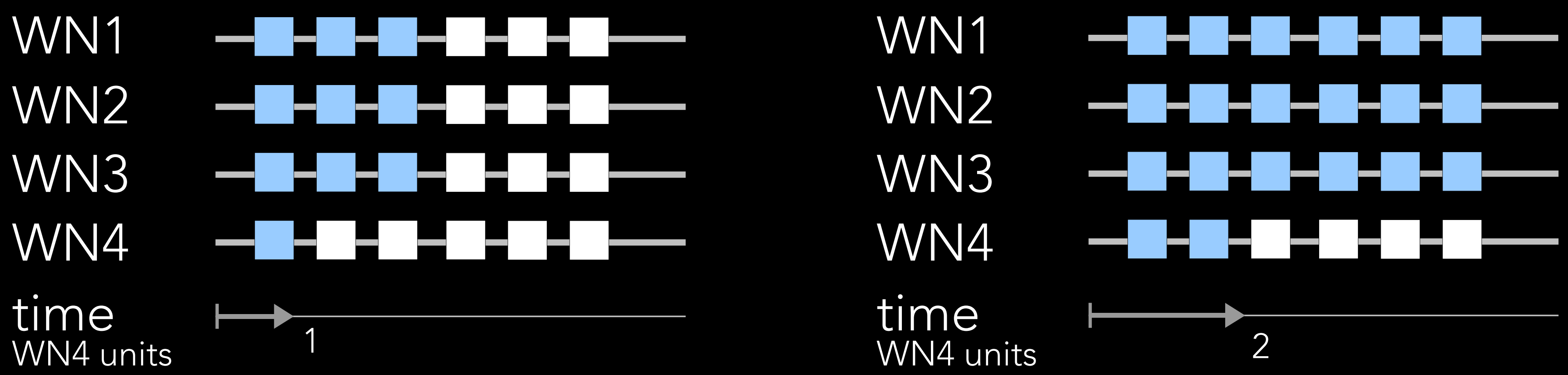

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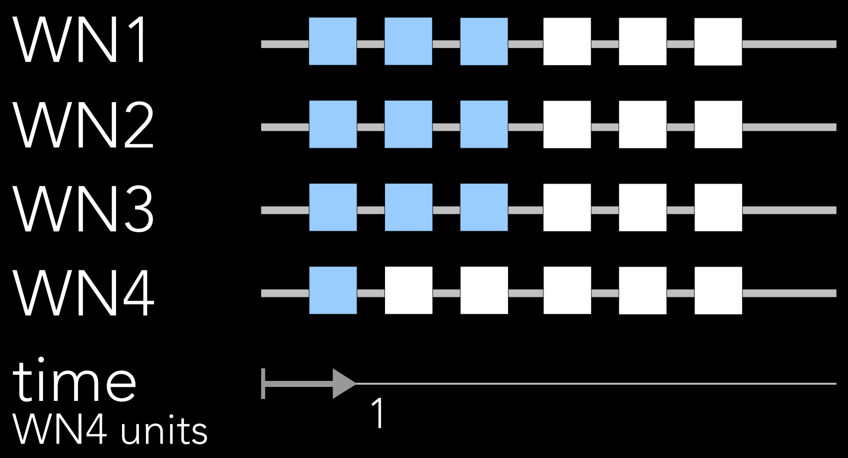
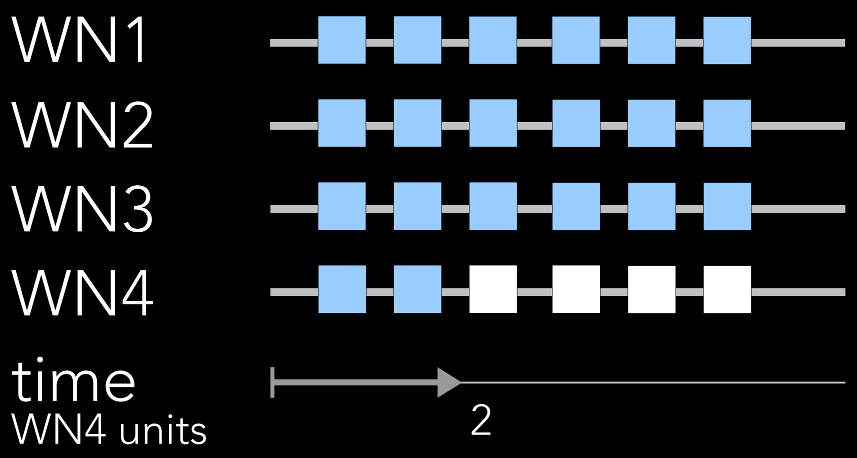
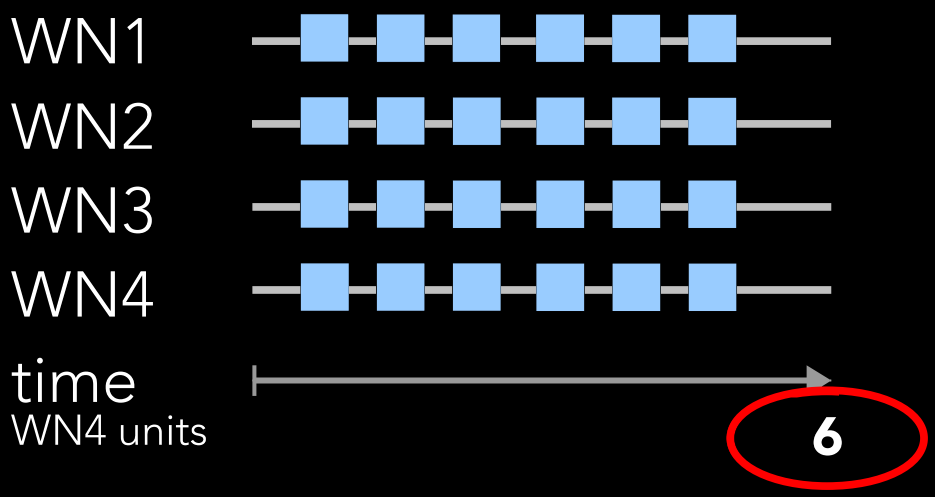
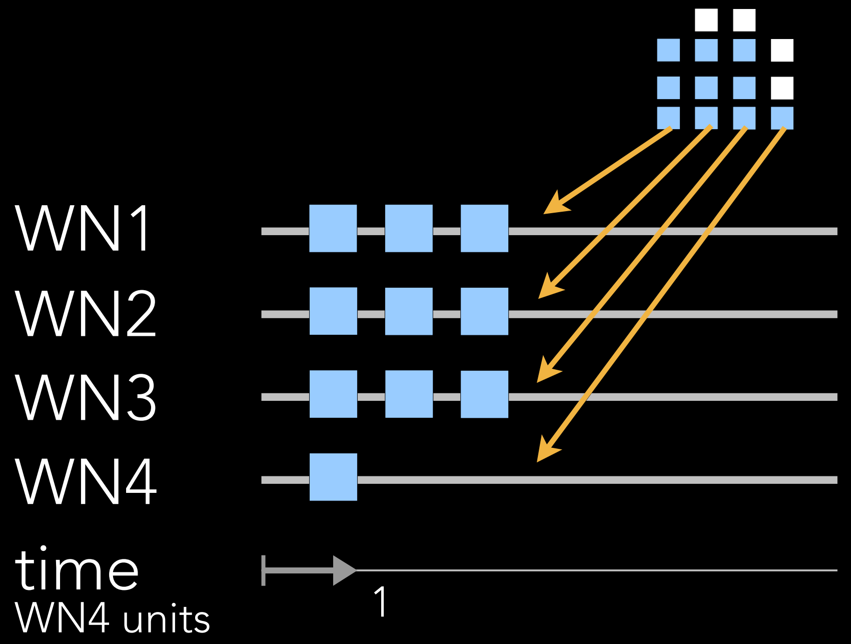






The slowest worker node sets the processing time

LOAD BALANCING: DYNAMIC



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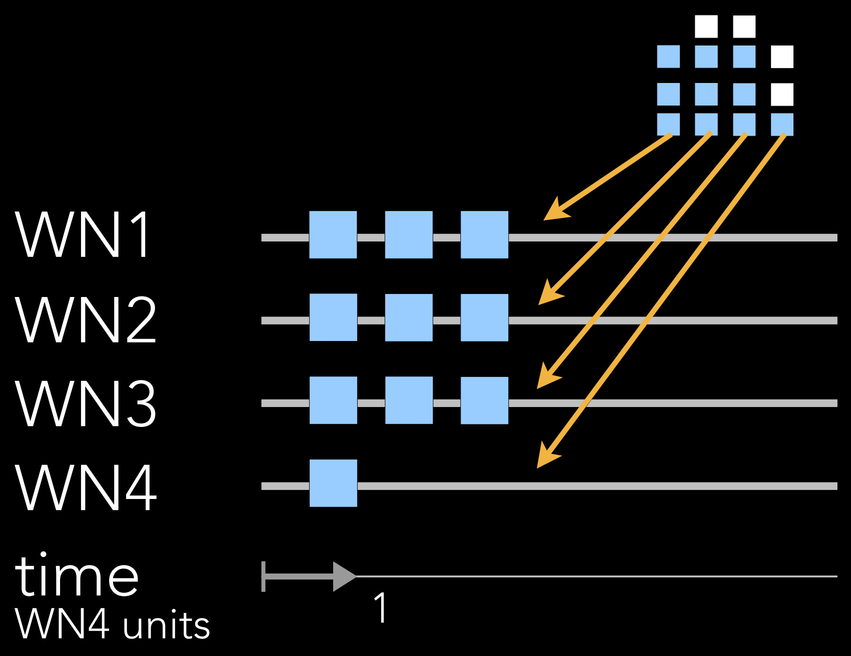
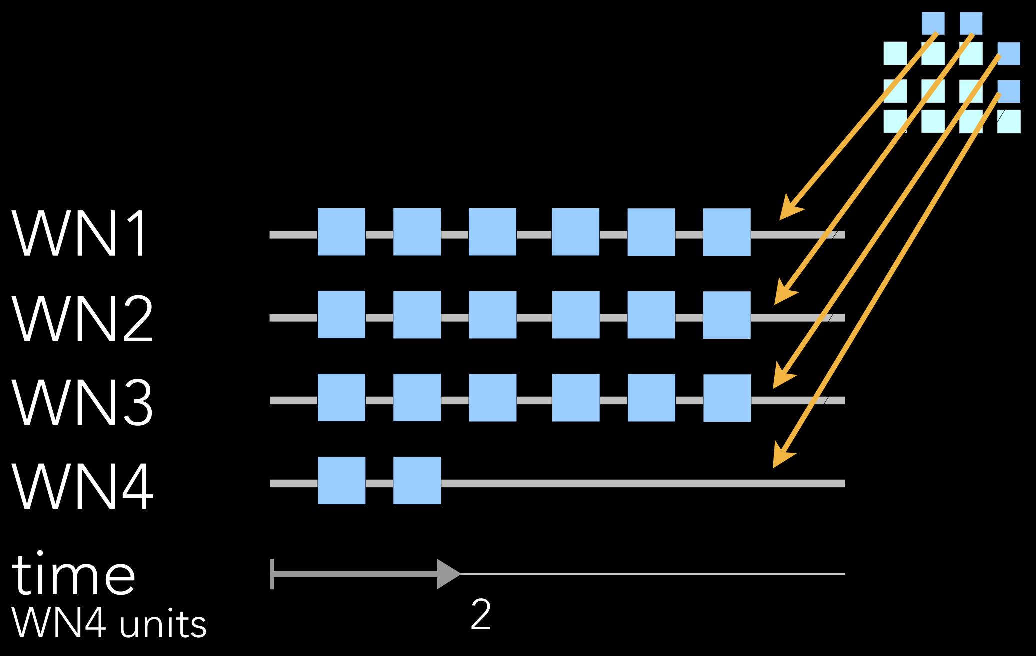
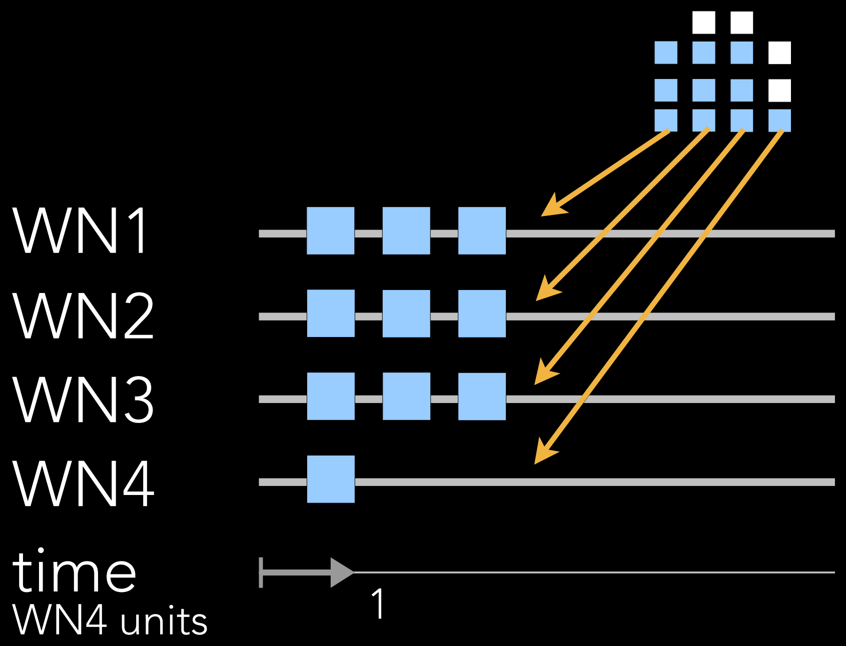
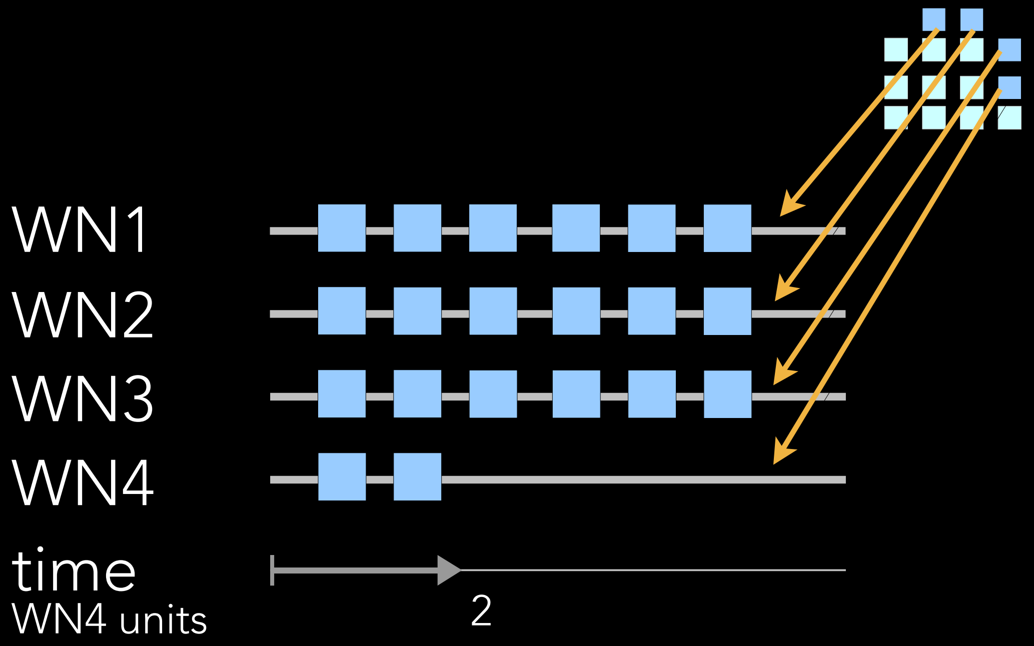
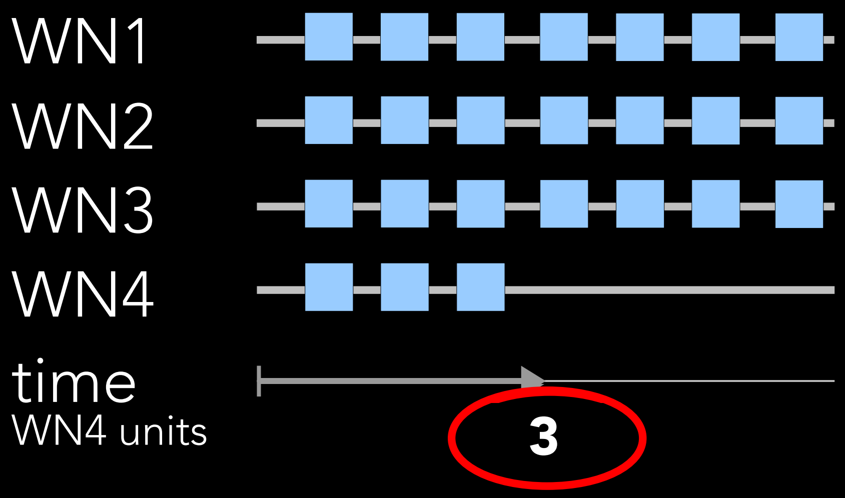




LOAD BALANCING: DYNAMIC





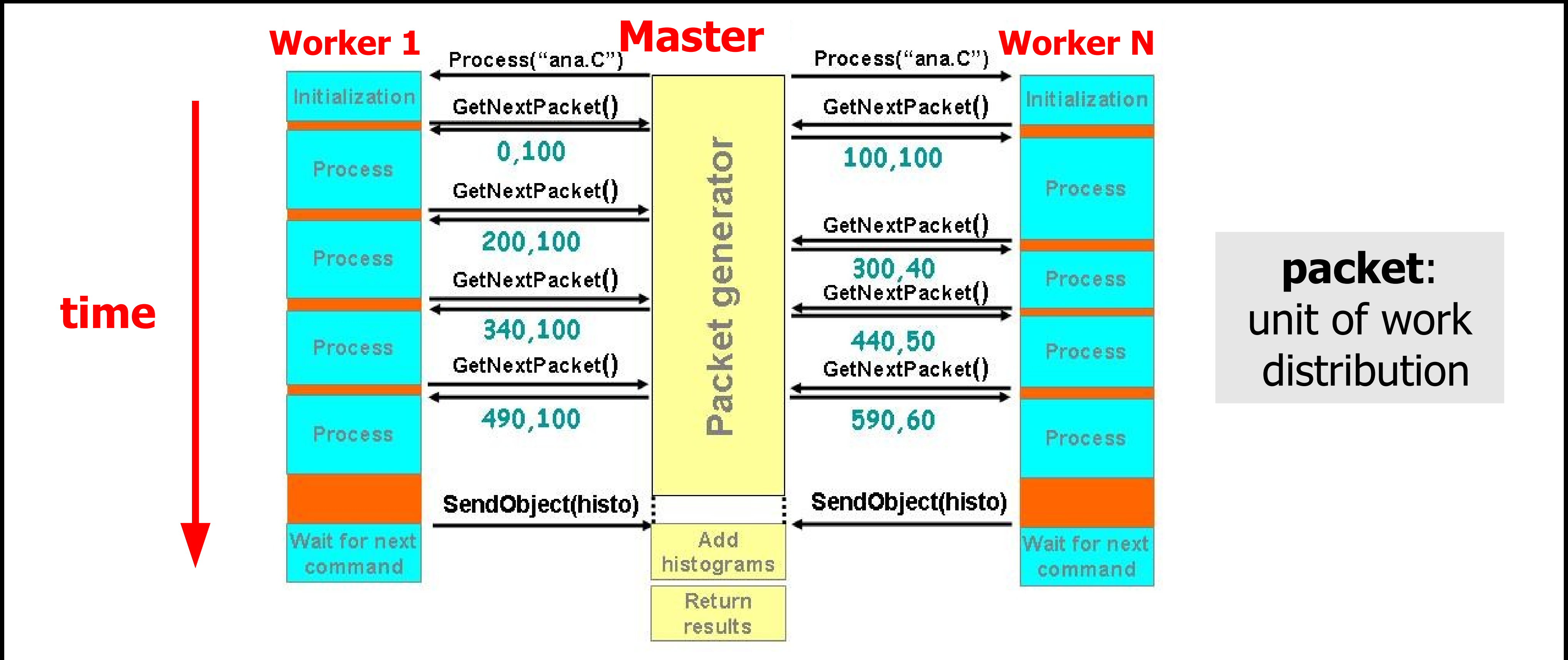


The slowest worker node gets less work to do: the processing time is less affected by its under performance

PULL ARCHITECTURE

- Let the workers ask for more work when idle
    - Adapt dynamically the work load to their speed
- The unit of work is called **packet**: a range of events
- **Packetizer** is the heart of the system
    - Controls packet generation and distribution
        - Measures real-time worker performance to use it in the determination of the next packet size

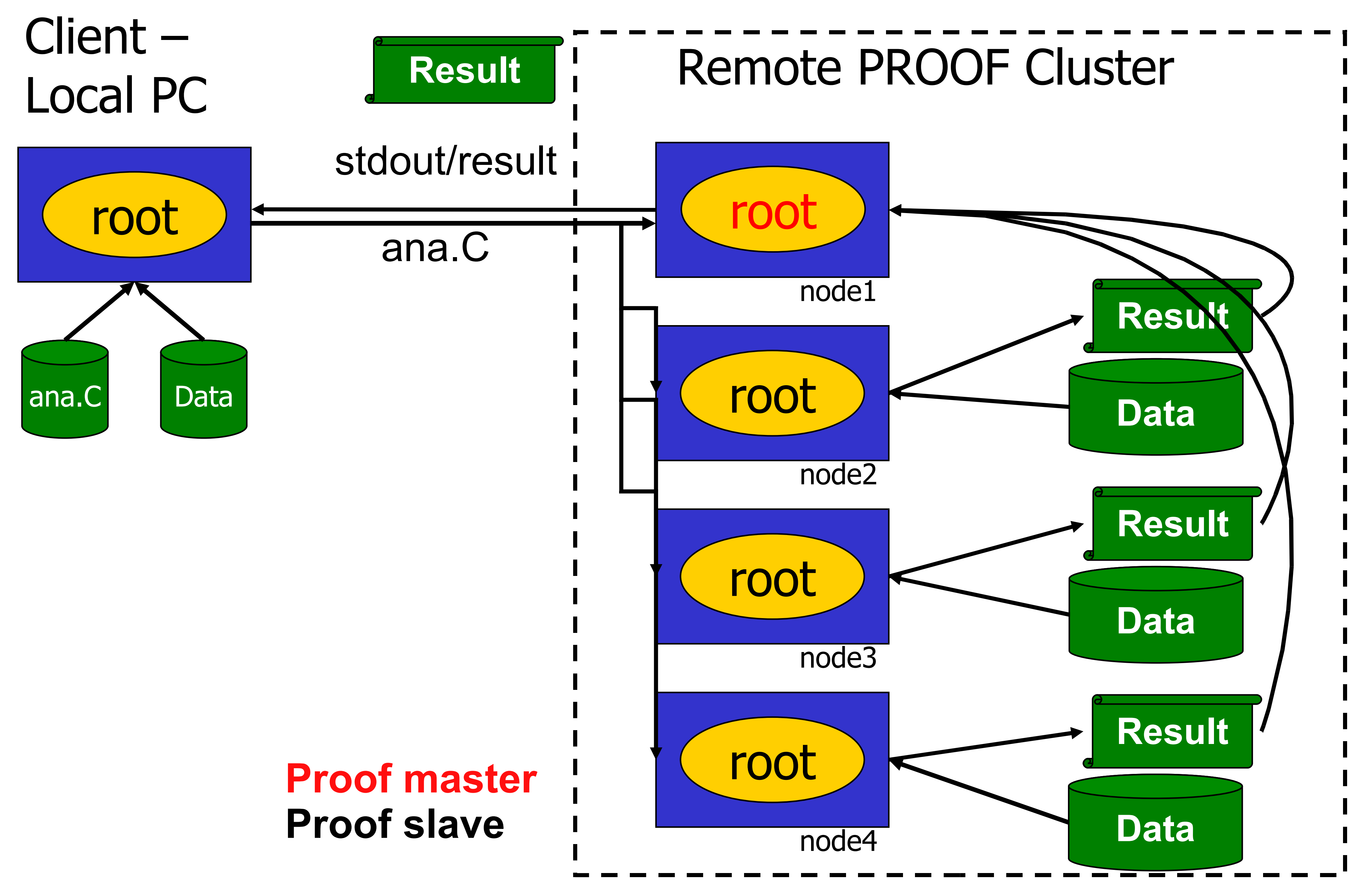
DYNAMIC LOAD BALANCING



packet: unit of work distribution

- Pull architecture guarantees scalability
- Adapts to performance variations

WORKFLOW



Client –
Local PC
Result
stdout/result
Remote PROOF Cluster
root
ana.C
ana.C
Data
root
node1
Result
root
Data
node2
Result
root
Data
node3
Result
root
Data
node4
Proof master
Proof slave

MERGING OUTPUT OBJECTS

- Standard ROOT objects provide **Merge** method

```
Long64_t Merge(TCollection *objectsToBeMerged)
```

- PROOF automatically merges standard ROOT objects
  - `TH1, TH2, TH3, TTree, …`
- If **Merge** method is not found, N objects received by the workers are just sent back to the client as they are

FEATURES

- Transparent to ROOT
  - Basically PROOF can run the ROOT code that can be run on localhost
- Interactive parallel execution of independent tasks
- Interactive-Batch
  - Can leave a processing session in the background, disconnect and reconnect later on to check the result
- Real-time Feedback

WHERE TO USE PROOF

- CAF, e.g. KIAF
- Workgroup facilities
- Multi-core desktops/laptops

RECAP

- PROOF features dynamic load balancing
    - Pull architecture
    - Event-level parallelism
        - Automatic splitting / merging
- PROOF is transparent to ROOT
    - The same code can be run locally and in PROOF

TERMINOLOGY

- Client
  - Machine running a ROOT session opening the connection to the PROOF master
- Master
  - PROOF machine running a ROOT session coordinating the work between workers and merging the results
- Worker (or Slave)
  - PROOF machine running a ROOT application doing the actual work
- Query
  - Process request submitted by the client to the Master
- Package / PAR file
  - Additional code needed by the selector but not available on the PROOF cluster, loaded as a separate library
  - Gzipped tarball containing all what needed to enable the package
- Selector
  - A class deriving from `TSelector` providing the code to be processed
- Chain
  - Instance of `TChain` with the list of files containing the `TTree` to be processed
- Dataset, TFileCollection
  - list of files containing the `TTree` to be processed

REFERENCES

- TWiki pages
  - http://root.cern.ch/drupal/content/proof
- ROOT site
  - http://root.cern.ch/root/html/ClassIndex.html
- ROOT forum
  - http://root.cern.ch/phpBB2/index.php
- This tutorial
  - https://root.cern.ch/drupal/content/proof-hands-tutorial
  - And Gerardo Ganis (CERN)'s ROOT tutorial

PART II

KIAF BASICS

PREREQUISITE 1

- Grid CA
  - CERN CA: gridca.cern.ch
  - KISTI CA: ca.gridcenter.or.kr
    - Contact: ca@gridcenter.or.kr
- ALICE VO (Must be an ALICE experiment member at least as an external)
  - Grid CA must be registered ALICE DB
    - https://lcg-voms2.cern.ch:8443/voms/alice/user/home.action
    - Contact: latchezar.Betev@cern.ch
- PEM key pair creation

```
$ openssl pkcs12 -in myCert.p12 -clcerts -nokeys -out $HOME/.globus/usercert.pem
```

```
$ openssl pkcs12 -in myCert.p12 -nocerts -out $HOME/.globus/userkey.pem
```

PREREQUISITE 2

- For Windows
  - Xming Setup for X11 forwarding
  - X11 forwarding enabling at Putty
- For Linux
  - Make sure X11 forwarding enabled when SSH connection is made: -Y (or -X, SL5)

STARTING PROOF@KIAF

- Open the following URL with your credential to obtain 1h token
    - `https://kiaf.sdfarm.kr:8443/auth`
- SSH to `kiaf.sdfarm.kr`
    - Use your CA private key

```
$ ssh -i ~/.globus/userkey.pem -p4280 -Y kiaf.sdfarm.kr
```

- Environment Setup
    - Create or modify `$HOME/.alice_env/alice_env.conf` file

```
$ mkdir $HOME/.alice_env
$ cat > $HOME/.alice_env/alice_env.conf << _EOF_
> export ALICE_ROOT_VERSION=“vAN-20141012”
> _EOF_
```

CREATE THE DIRECTORY IF IT DOES NOT EXIST

REPLACE WITH THE PACKAGE YOU WANT TO USE

- And run, then it will ask your credential for AliEn access

```
$ source /pool/podenv
```

KIAF

- KISTI Analysis Facility
  - Full functionality is available for ALICE user only
    - Requires grid authentication
    - E.g. dataset registration
  - Running PROOF code is still allowed w/o authentication

KIAF SPECIFICATION

- Structure
  - 1 Master
  - 8 Slaves
    - 24 workers per slave provides 192 workers in total
- Resource Management System
  - HTCondor
    - Common HTCondor tool is available

```
$ condor_status
$ condor_q
```

- **PROOF on Demand** (setup of PoD is out of scope from this tutorial)
- Xrootd enabled for dataset management

POD

- PROOF on Demand
  - Tool-set to setup PROOF on any **R**esource **M**anagement **S**ystem
  - Developed at GSI, Darmstadt, Germany
    - Author: Anar Manafov (A.Manafov@gsi.de)
  - Documented at http://pod.gsi.de
  - Plug-in based interaction with RMS
    - gLite, LSF, PBS, OGE, Condor, LoadLeveler
    - SSH plug-in for PW-less SSH connected clusters
- We will use PoD in this tutorial

POD BASIC

- PoD server is managed by pod-server command
  - pod-server -h
  - pod-server start | stop | restart
- Workers are claimed by pod-submit command
  - pod-submit -h
  - pod-submit -r condor -n <N>
- Information is retrieved by pod-info command, e.g. number of workers
  - pod-info -n

START PROOF ON DEMAND

```
$ source /pool/podenv
$ pod-server start
…
$ pod-submit -r condor -n <N>
…
$ pod-info -n
<N>
```

ROOF BASICS

```
$ root
$ root -l
$ root -q your_macro.C
$ root -h

$ root -l
root[0] .q

$ root -l
root[0] TBrowser b
root[1] .L your_macro.C
root[2] .L your_macro_to_be_compiled.C+
root[3] .x your_macro.C
root[4] .x your_macro_to_be_compiled.C+
root[5] .ls
root[6] 1+1
…
```

- CINT: interactive C/C++ statement interpreter
- Find yourself in $ROOTSYS/tutorials for useful ready-to-run macros
- ROOT reference guide available in http://root.cern.ch/root/html/

OPEN A PROOF SESSION

```
$ root -l
root [0] TProof *p = TProof::Open(“pod://")
Starting master: opening connection ...
Starting master: OK
Opening connections to workers: OK (10 workers)
Setting up worker servers: OK (10 workers)
PROOF set to parallel mode (10 workers)
(class TProof*)0x1e925b00
root [1]
```

OR

```
$ root -l
root [0] TProof *p = TProof::Open(“")
 +++ Starting PROOF-Lite with 24 workers +++
Opening connections to workers: OK (24 workers)
Setting up worker servers: OK (24 workers)
PROOF set to parallel mode (24 workers)
(class TProof*)0x15c9e2a0
root [1]
```

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OR

WHAT IS DIFFERENCE?

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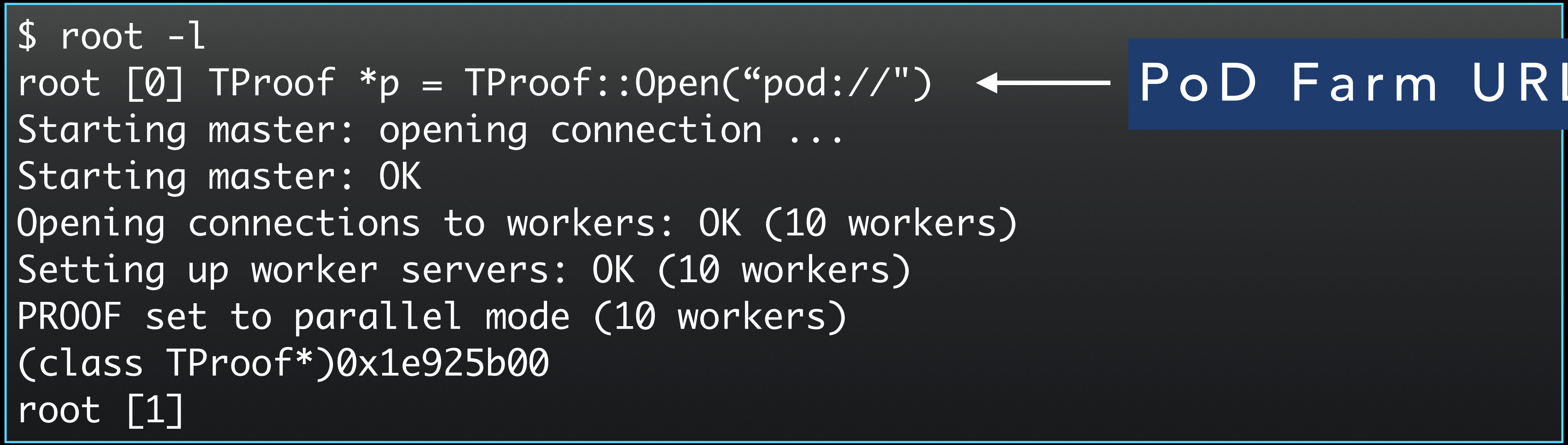

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root [0] TProof *p = TProof::Open(“pod://")
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PROOF set to parallel mode (10 workers)
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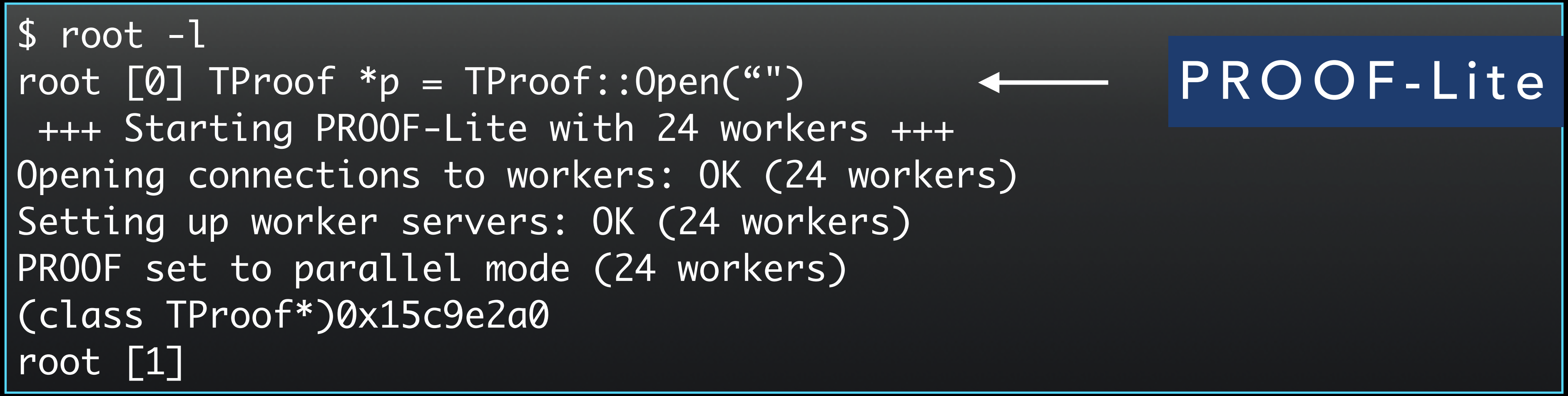
root [1]
```

PoD Farm URL

OR



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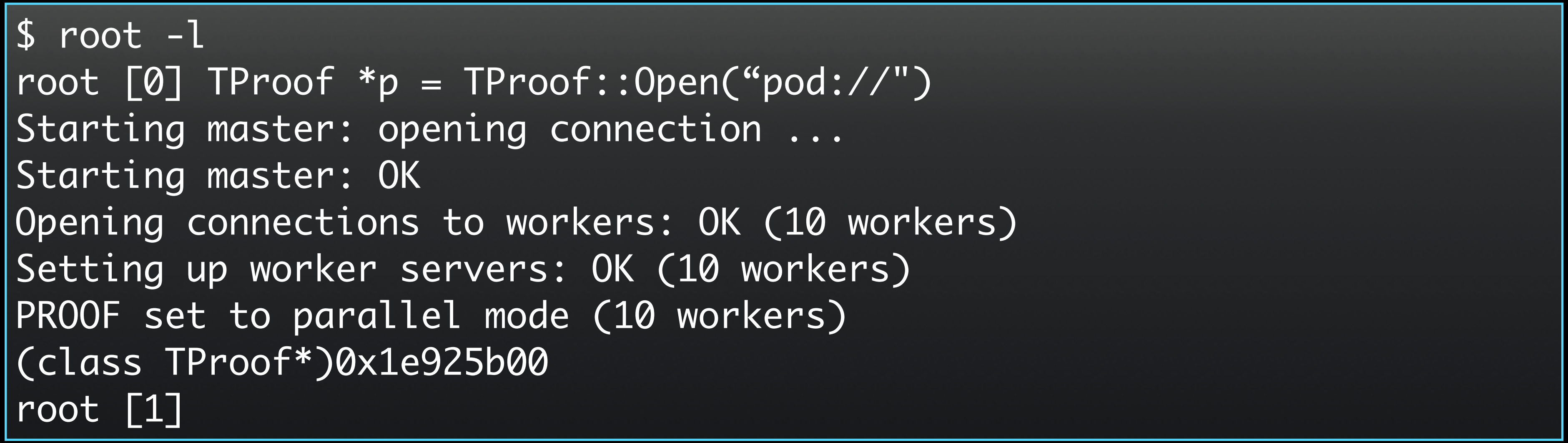
```

PROOF-Lite

TPROOF: THE PROOF SHELL



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root [0] TProof *p = TProof::Open(“pod://")
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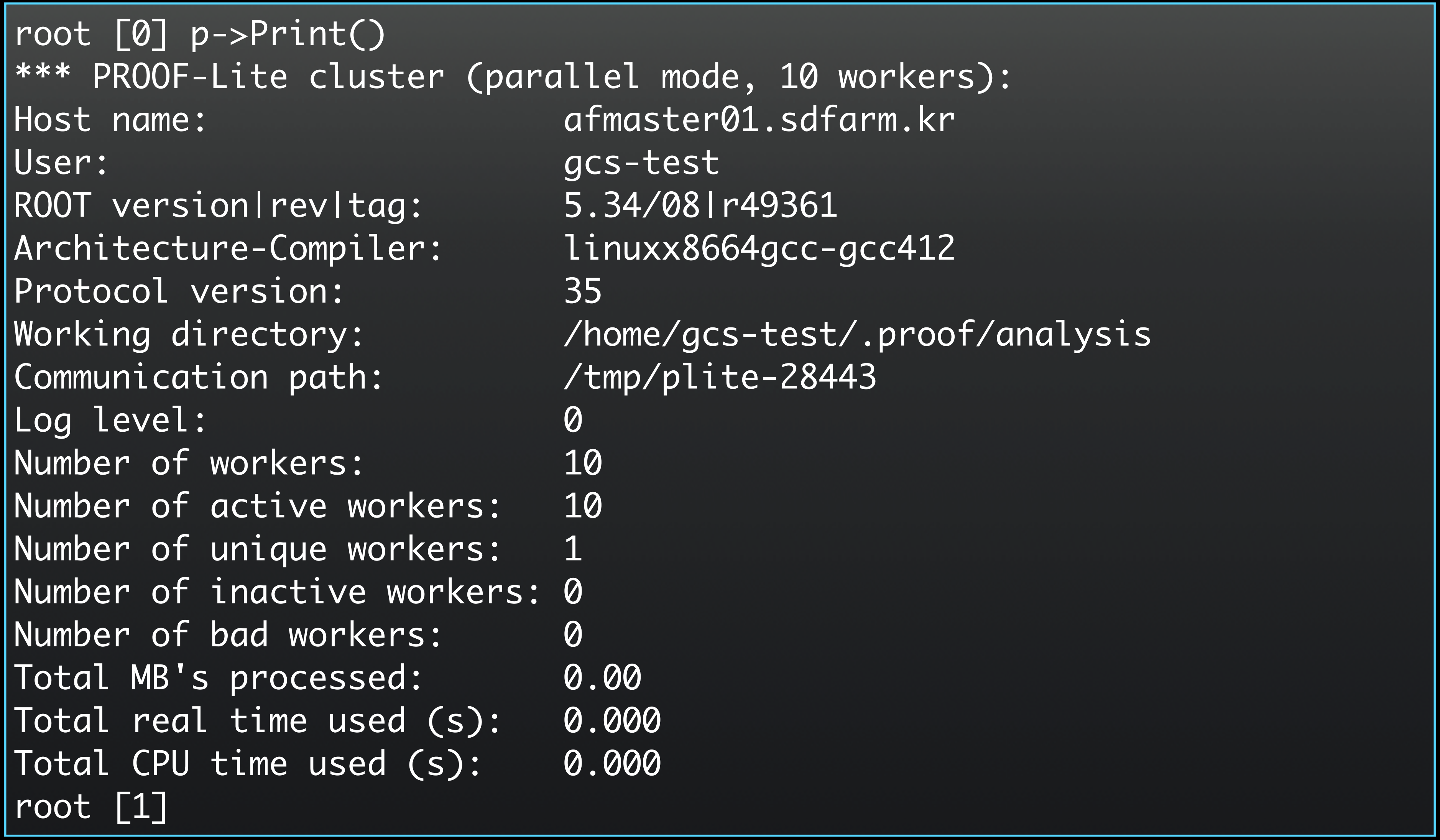
PROOF set to parallel mode (10 workers)
(class TProof*)0x1e925b00
root [1]
```

TProof: the PROOF shell

- Interface class
- Everything on the session will be through the TProof class methos
  - Print(), Exec(), AddInput(), Process(), GetOutputList(), DrawSelect(), …

gProof: global pointer to the latest TProof intance

TRY IT OUT:PRINT()



```
root [0] p->Print()
*** PROOF-Lite cluster (parallel mode, 10 workers):
Host name:                  afmaster01.sdfarm.kr
User:                       gcs-test
ROOT version|rev|tag:       5.34/08|r49361
Architecture-Compiler:      linuxx8664gcc-gcc412
Protocol version:           35
Working directory:          /home/gcs-test/.proof/analysis
Communication path:         /tmp/plite-28443
Log level:                  0
Number of workers:          10
Number of active workers:   10
Number of unique workers:   1
Number of inactive workers: 0
Number of bad workers:      0
Total MB's processed:       0.00
Total real time used (s):   0.000
Total CPU time used (s):    0.000
root [1]
```

SANDBOX

- Working space
  - `$HOME/.proof` (default location)
  - PROOF-Lite: `$HOME/.proof/path-from-where-we-started`
- Sub-directories
  - cache
    - Cache package tarballs, selector code and binaries
  - packages
    - Area where packages are actually build / installed
  - session-*sessionUniqueID*
    - Working area for session "sessionUniqueID"
  - queries (on master only)
    - Where the results of processing are stored
  - datasets (on master only)
    - Information about datasets

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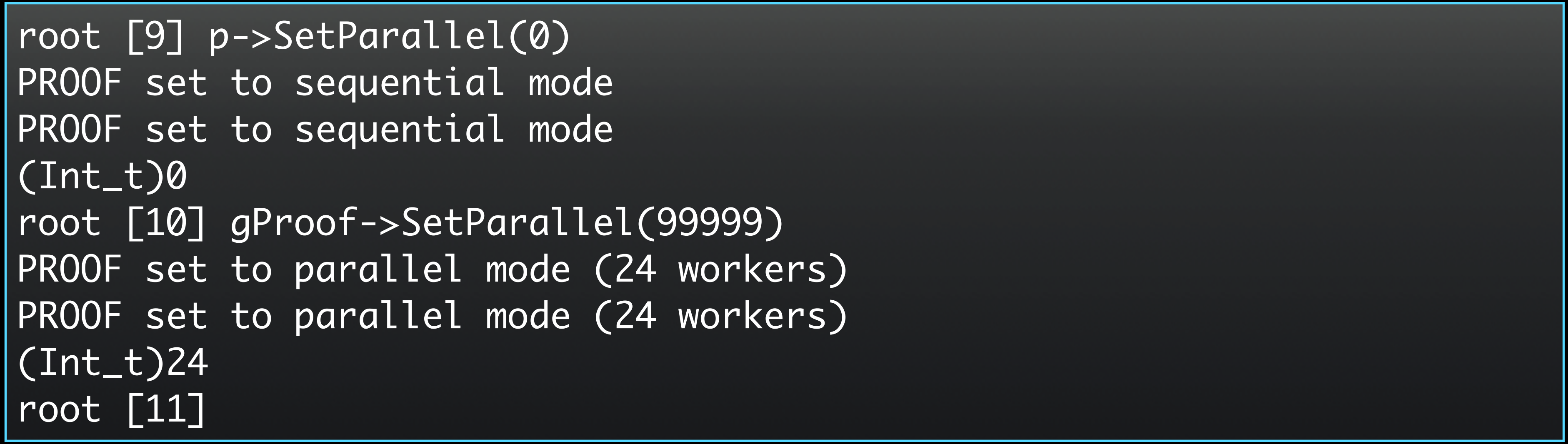
hostname-creationtime-processID

SWITCHING MODE:
PARALLEL ↔ SEQUENTIAL



```
root [9] p->SetParallel(0)
PROOF set to sequential mode
PROOF set to sequential mode
(Int_t)0
root [10] gProof->SetParallel(99999)
PROOF set to parallel mode (24 workers)
PROOF set to parallel mode (24 workers)
(Int_t)24
root [11]
```

TRY IT OUT:EXEC()

```
root [0] p->SetParallel(0)
root [1] p->Exec(“.!pwd”)
root [2] p->Exec(“.!ls -lt <directory>”)
```

```
root [0] p->SetParallel(99999)
root [1] p->Exec(“.!pwd”)
root [2] p->Exec(“.!ls -lt <directory>”)
```

SIMPLE TASK PROCESSING

- We are ready to run a first query
- `tutorial/ProofSimple.C`
  - Defines a `TSelector` which fills 100 histograms with gaussian random numbers
- Just do

```
root [1] p->Process(“tutorial/ProofSimple.C+",10000)
Mst-0: merging output objects ... done
Mst-0: grand total: sent 107 objects, size: 93962 bytes
(Long64_t)0
root [2]
```

SIMPLE TASK PROCESSING

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- `tutorial/ProofSimple.C`
  - Defines a **`TSelector`** which fills 100 histograms with gaussian random numbers
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root [2]
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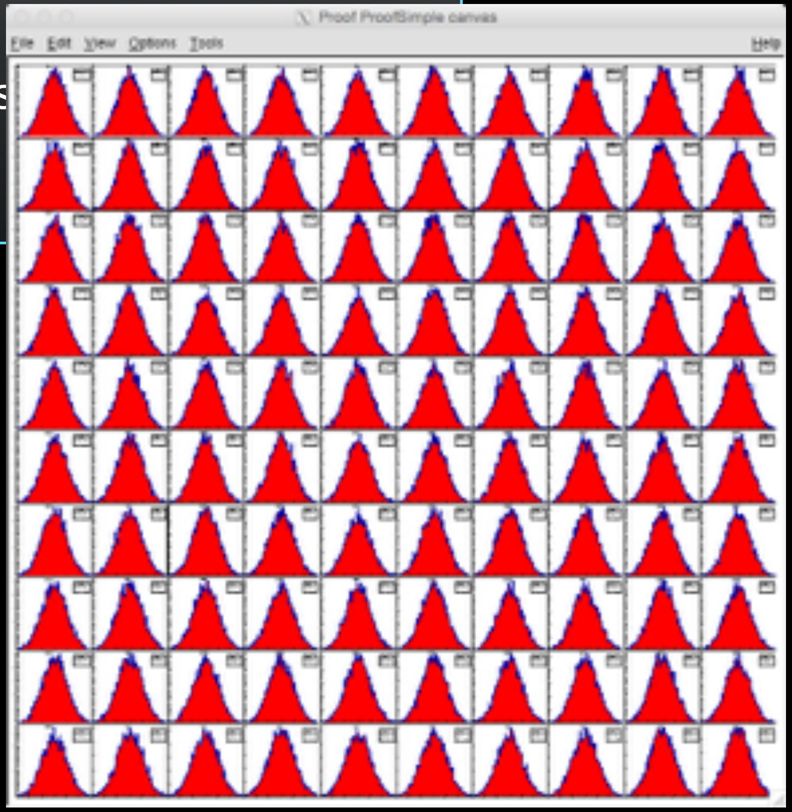
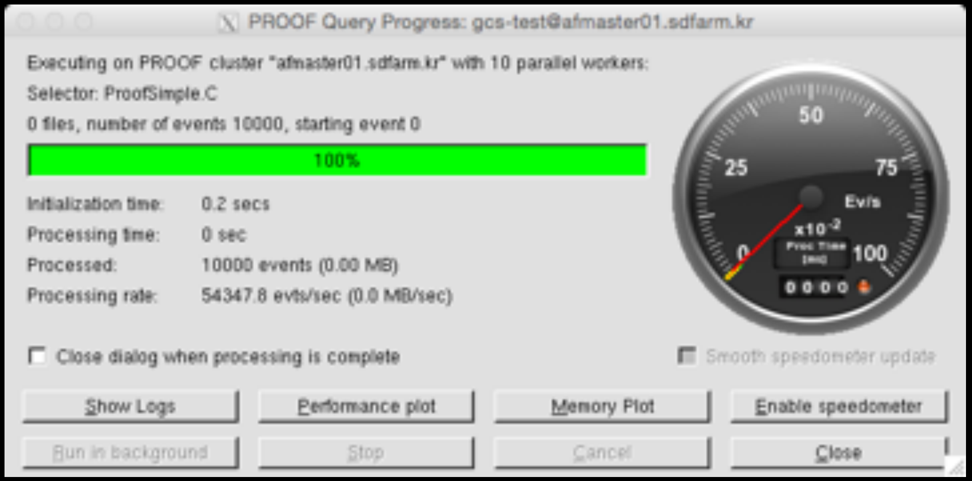



PROOF Query Progress: gcs-test@afmaster01.sdfarm.kr

Executing on PROOF cluster "afmaster01.sdfarm.kr" with 10 parallel workers:

Selector: ProofSimple.C

0 files, number of events 10000, starting event 0

100%

Initialization time: 0.2 secs

Processing time: 0 sec

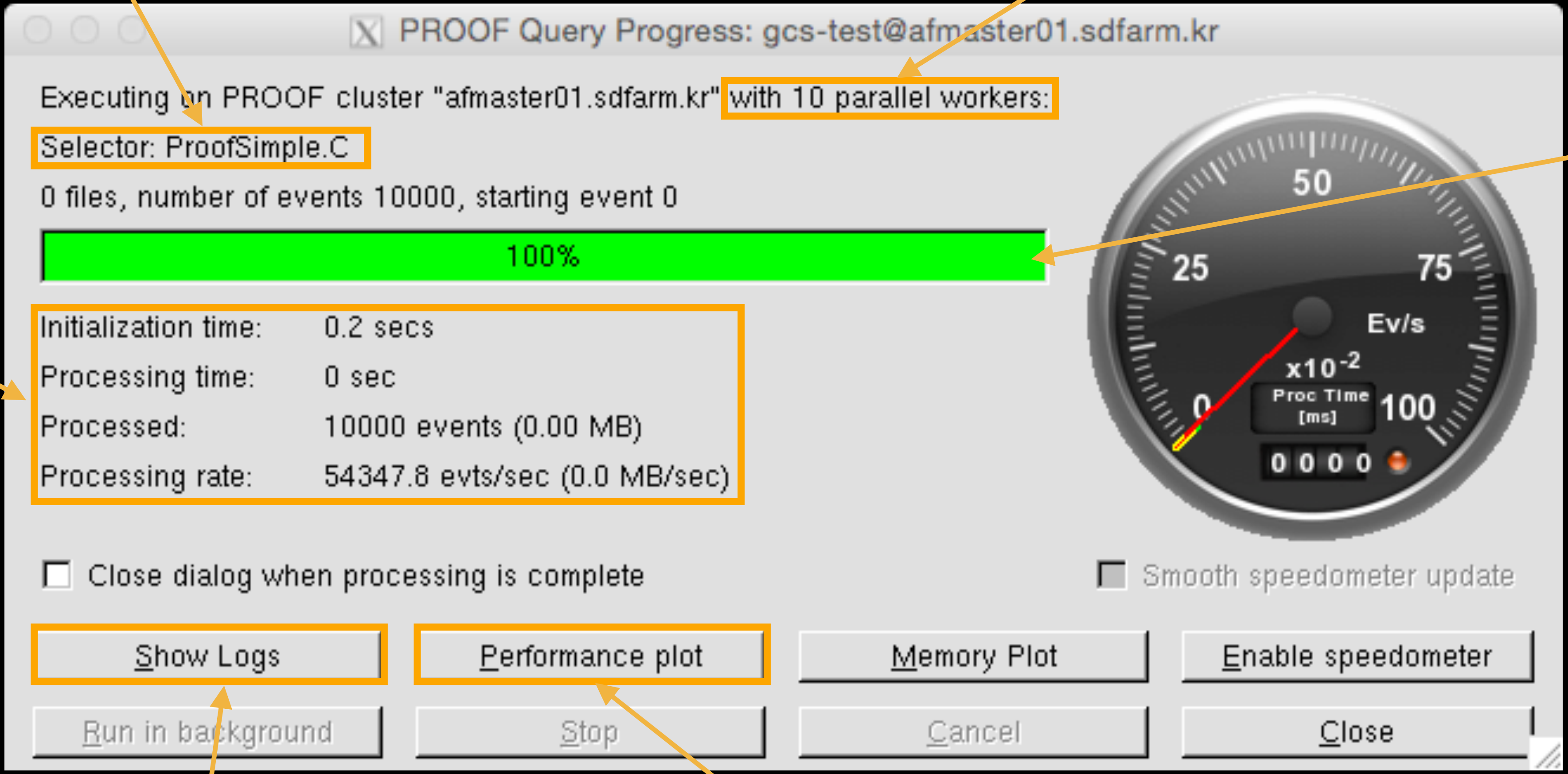
Processed: 10000 events (0.00 MB)

Processing rate: 54347.8 evts/sec (0.0 MB/sec)

□ Close dialog when processing is complete

□ Smooth speedometer update

DIALOG BOX



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```
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Processed:             10000 events (0.00 MB)
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```

☐ Close dialog when processing is complete

☐ Smooth speedometer update

Selector being run

Active workers

Progress bar

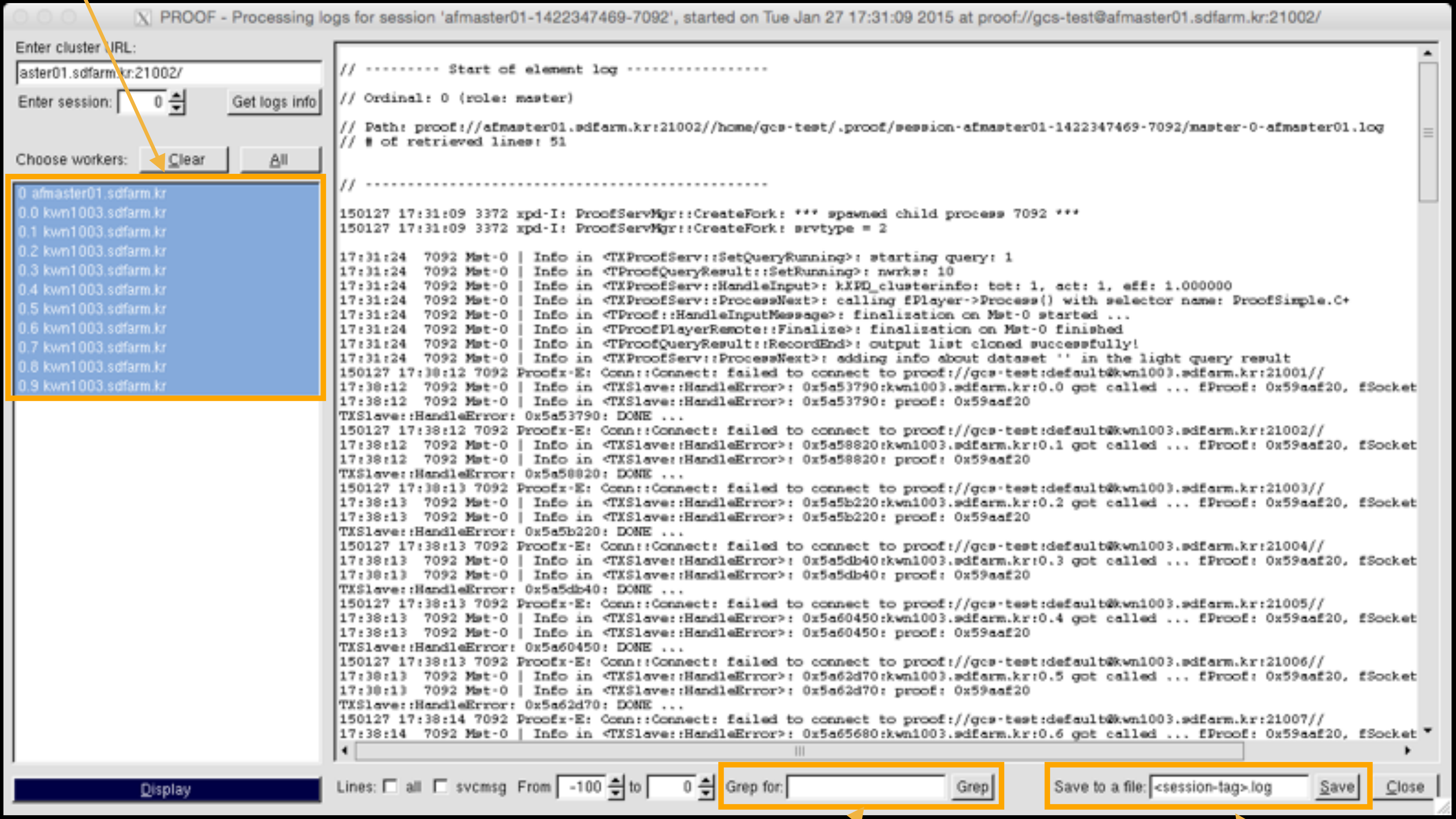
Stats

Log dialog box

Performance plot box

LOG DIALOG BOX

Select logs to display



PROOF - Processing logs for session 'afmaster01-1422347469-7092', started on Tue Jan 27 17:31:09 2015 at proof://gcs-test@afmaster01.sdfarm.kr:21002/

Enter cluster URL: aster01.sdfarm.kr:21002/

Enter session: 0

Choose workers:

- 0 afmaster01.sdfarm.kr
- 0.0 kwn1003.sdfarm.kr
- 0.1 kwn1003.sdfarm.kr
- 0.2 kwn1003.sdfarm.kr
- 0.3 kwn1003.sdfarm.kr
- 0.4 kwn1003.sdfarm.kr
- 0.5 kwn1003.sdfarm.kr
- 0.6 kwn1003.sdfarm.kr
- 0.7 kwn1003.sdfarm.kr
- 0.8 kwn1003.sdfarm.kr
- 0.9 kwn1003.sdfarm.kr

```
// --------- Start of element log -----------------

// Ordinal: 0 (role: master)

// Path: proof://afmaster01.sdfarm.kr:21002//home/gcs-test/.proof/session-afmaster01-1422347469-7092/master-0-afmaster01.log
// # of retrieved lines: 51


// ---------------------------------------------

150127 17:31:09 3372 xpd-I: ProofServMgr::CreateFork: *** spawned child process 7092 ***
150127 17:31:09 3372 xpd-I: ProofServMgr::CreateFork: srvtype = 2

17:31:24  7092 Mst-0 | Info in <TXProofServ::SetQueryRunning>: starting query: 1
17:31:24  7092 Mst-0 | Info in <TProofQueryResult::SetRunning>: nwrks: 10
17:31:24  7092 Mst-0 | Info in <TXProofServ::HandleInput>: kXPD_clusterinfo: tot: 1, act: 1, eff: 1.000000
17:31:24  7092 Mst-0 | Info in <TXProofServ::ProcessNext>: calling fPlayer->Process() with selector name: ProofSimple.C+
17:31:24  7092 Mst-0 | Info in <TProof::HandleInputMessage>: finalization on Mst-0 started ...
17:31:24  7092 Mst-0 | Info in <TProofPlayerRemote::Finalize>: finalization on Mst-0 finished
17:31:24  7092 Mst-0 | Info in <TProofQueryResult::RecordEnd>: output list cloned successfully!
17:31:24  7092 Mst-0 | Info in <TXProofServ::ProcessNext>: adding info about dataset '' in the light query result
150127 17:38:12 7092 Proofx-E: Conn::Connect: failed to connect to proof://gcs-test:default@kwn1003.sdfarm.kr:21001//
17:38:12  7092 Mst-0 | Info in <TXSlave::HandleError>: 0x5a53790:kwn1003.sdfarm.kr:0.0 got called ... fProof: 0x59aaf20, fSocket
17:38:12  7092 Mst-0 | Info in <TXSlave::HandleError>: 0x5a53790: proof: 0x59aaf20
TXSlave::HandleError: 0x5a53790: DONE ...
150127 17:38:12 7092 Proofx-E: Conn::Connect: failed to connect to proof://gcs-test:default@kwn1003.sdfarm.kr:21002//
17:38:12  7092 Mst-0 | Info in <TXSlave::HandleError>: 0x5a58820:kwn1003.sdfarm.kr:0.1 got called ... fProof: 0x59aaf20, fSocket
17:38:12  7092 Mst-0 | Info in <TXSlave::HandleError>: 0x5a58820: proof: 0x59aaf20
TXSlave::HandleError: 0x5a58820: DONE ...
150127 17:38:13 7092 Proofx-E: Conn::Connect: failed to connect to proof://gcs-test:default@kwn1003.sdfarm.kr:21003//
17:38:13  7092 Mst-0 | Info in <TXSlave::HandleError>: 0x5a5b220:kwn1003.sdfarm.kr:0.2 got called ... fProof: 0x59aaf20, fSocket
17:38:13  7092 Mst-0 | Info in <TXSlave::HandleError>: 0x5a5b220: proof: 0x59aaf20
TXSlave::HandleError: 0x5a5b220: DONE ...
150127 17:38:13 7092 Proofx-E: Conn::Connect: failed to connect to proof://gcs-test:default@kwn1003.sdfarm.kr:21004//
17:38:13  7092 Mst-0 | Info in <TXSlave::HandleError>: 0x5a5db40:kwn1003.sdfarm.kr:0.3 got called ... fProof: 0x59aaf20, fSocket
17:38:13  7092 Mst-0 | Info in <TXSlave::HandleError>: 0x5a5db40: proof: 0x59aaf20
TXSlave::HandleError: 0x5a5db40: DONE ...
150127 17:38:13 7092 Proofx-E: Conn::Connect: failed to connect to proof://gcs-test:default@kwn1003.sdfarm.kr:21005//
17:38:13  7092 Mst-0 | Info in <TXSlave::HandleError>: 0x5a60450:kwn1003.sdfarm.kr:0.4 got called ... fProof: 0x59aaf20, fSocket
17:38:13  7092 Mst-0 | Info in <TXSlave::HandleError>: 0x5a60450: proof: 0x59aaf20
TXSlave::HandleError: 0x5a60450: DONE ...
150127 17:38:13 7092 Proofx-E: Conn::Connect: failed to connect to proof://gcs-test:default@kwn1003.sdfarm.kr:21006//
17:38:13  7092 Mst-0 | Info in <TXSlave::HandleError>: 0x5a62d70:kwn1003.sdfarm.kr:0.5 got called ... fProof: 0x59aaf20, fSocket
17:38:13  7092 Mst-0 | Info in <TXSlave::HandleError>: 0x5a62d70: proof: 0x59aaf20
TXSlave::HandleError: 0x5a62d70: DONE ...
150127 17:38:14 7092 Proofx-E: Conn::Connect: failed to connect to proof://gcs-test:default@kwn1003.sdfarm.kr:21007//
17:38:14  7092 Mst-0 | Info in <TXSlave::HandleError>: 0x5a65680:kwn1003.sdfarm.kr:0.6 got called ... fProof: 0x59aaf20, fSocket
```

Lines: □ all □ svcmsg From -100 to 0

Grep for:

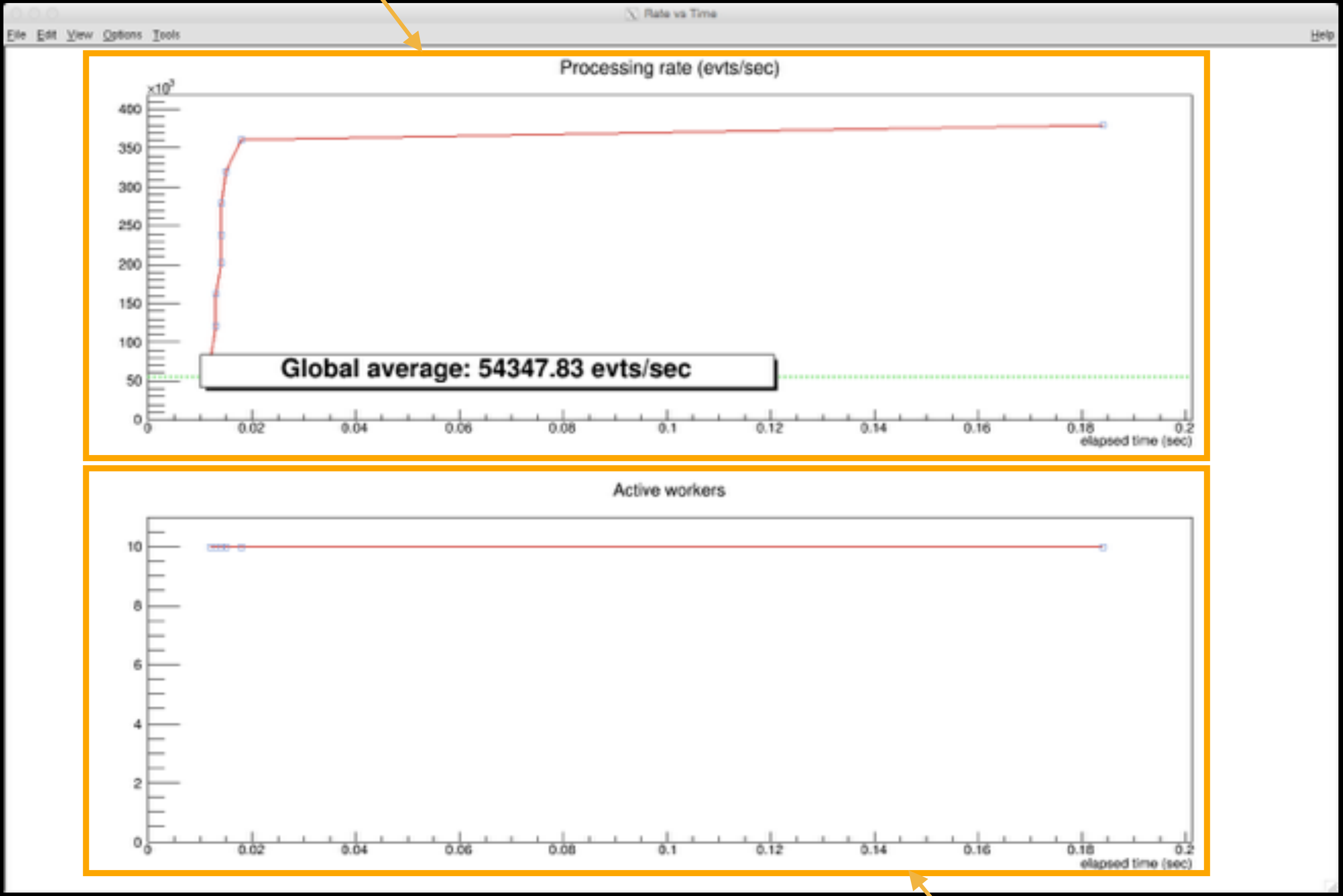
Save to a file: <session-tag>.log

Grep functionality

Save to file

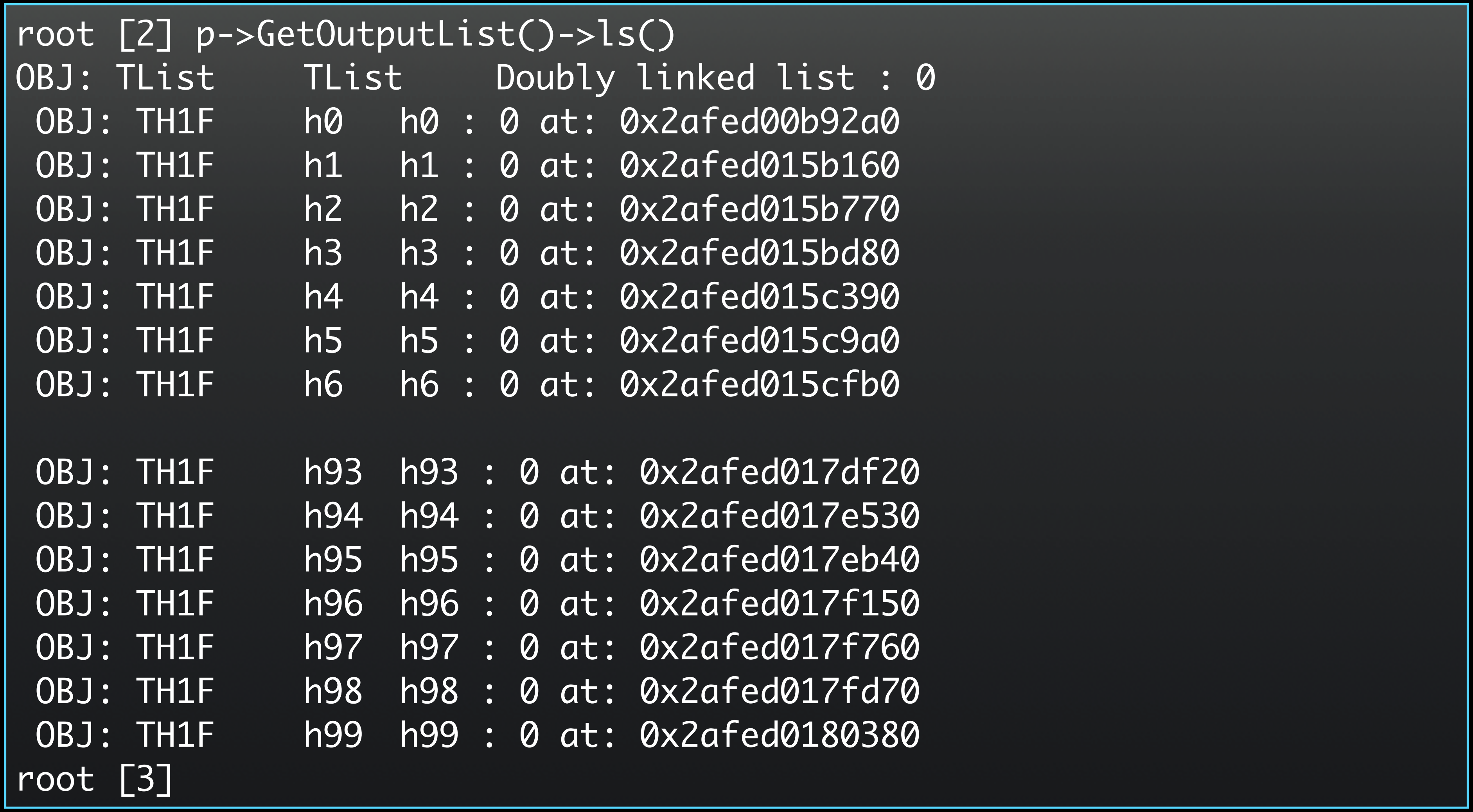
PERFORMANCE PLOT

Processing performance



Number of active workers during the process

OUTPUT LIST



```
root [2] p->GetOutputList()->ls()
OBJ: TList     TList     Doubly linked list : 0
 OBJ: TH1F     h0   h0 : 0 at: 0x2afed00b92a0
 OBJ: TH1F     h1   h1 : 0 at: 0x2afed015b160
 OBJ: TH1F     h2   h2 : 0 at: 0x2afed015b770
 OBJ: TH1F     h3   h3 : 0 at: 0x2afed015bd80
 OBJ: TH1F     h4   h4 : 0 at: 0x2afed015c390
 OBJ: TH1F     h5   h5 : 0 at: 0x2afed015c9a0
 OBJ: TH1F     h6   h6 : 0 at: 0x2afed015cfb0

 OBJ: TH1F     h93  h93 : 0 at: 0x2afed017df20
 OBJ: TH1F     h94  h94 : 0 at: 0x2afed017e530
 OBJ: TH1F     h95  h95 : 0 at: 0x2afed017eb40
 OBJ: TH1F     h96  h96 : 0 at: 0x2afed017f150
 OBJ: TH1F     h97  h97 : 0 at: 0x2afed017f760
 OBJ: TH1F     h98  h98 : 0 at: 0x2afed017fd70
 OBJ: TH1F     h99  h99 : 0 at: 0x2afed0180380
root [3]
```

WHERE OUTPUT IS DEFINED?

tutotial/ProofSimple.C

```
ProofSimple::ProofSimple()
{
   // Constructor
   fNhist = 100;
   …
}
void ProofSimple::SlaveBegin(TTree * /*tree*/)
{
   …
   fHist = new TH1F*[fNhist];
   …
   TString hn;
   // Create the histogram
   for (Int_t i=0; i < fNhist; i++) {
      hn.Form("h%d",i);
      fHist[i] = new TH1F(hn.Data(), hn.Data(), 100, -3., 3.);
      fHist[i]->SetFillColor(kRed);
      fOutput->Add(fHist[i]);
   }
```

CREATE A MACRO TO RUN PROOF

- Avoid repeating all commands each time to start PROOF session

- Here is an example:

```
void runProof(const char *option = "simple",
                const char *master = "pod://")
{
     // Get the option into a TString for easier manipulation
     TString opt(option);

     // Start or attach to PROOF
     TProof *p = TProof::Open(master);
     if(!p) {
          Printf("runProof: could not get PROOF at '%s'", master);
          return;
     }

     // Run according to option
     if(opt.Contains("simple")) {
          p->Process("tutorial/ProofSimple.C+", 10000);
     }
}
```

LOADING ADDITIONAL CODE

- When the selector requires additional code, e.g. a new class MyClass, PROOF provides two ways to make it available
  - `TProof::Load(“MyClass.C”)`
    - Equivalent of `.L` on the ROOT shell
    - Convenient for simple things
  - **P**ackage **AR**chives (PAR)
    - Structured archives with build and setup facilities
    - Convenient for more complex and stable things, e.g. the experiment analysis suite

PAR

- Zipped tarballs identified by a name and the .par extension, e.g. pack.par
- The tarball contains a structure like this

```
./pack
./pack/PROOF-INF
./pack/PROOF-INF/BUILD.sh
./pack/PROOF-INF/SETUP.C
```

- The code (`.C, .h, makefiles, …`) should be put in the top level directory
- `BUILD.sh` is the script to build the package, e.g. runs ‘make’
- `SETUP.C` is a macro running the final setup

PAR EXAMPLE

tutotial/event.par

```
$ tar tzvf tutorial/event.par
drwxr-xr-x ganis/sf          0 2010-05-25 19:06:34 event/
drwxr-xr-x ganis/sf          0 2011-02-18 21:04:44 event/PROOF-INF/
-rw-r--r-- ganis/sf        433 2011-02-18 20:54:10 event/PROOF-INF/SETUP.C
-rwxr-xr-x ganis/sf        414 2011-02-18 21:04:35 event/PROOF-INF/BUILD.sh
-rw-r--r-- ganis/sf      14695 2010-05-25 19:06:34 event/Event.cxx
-rw-r--r-- ganis/sf       2345 2010-05-25 19:06:34 event/Makefile
-rw-r--r-- ganis/sf       7901 2010-05-25 19:06:34 event/Event.h
-rw-r--r-- ganis/sf      13220 2010-05-25 19:06:34 event/Makefile.arch
-rw-r--r-- ganis/sf        259 2010-05-25 19:06:34 event/EventLinkDef.h
```

HANDLING PAR IN PROOF

- TProof provides the following methods to work with PAR

```
UploadPackage(const char *name)
EnalbePackage(const char *name)
ClearPackage(const char *name)
ClearPackages()
ShowPackages()
ShowEnabledPackages()
```

- Try to upload and enable tutorial/event.par

```
root [0] TProof *p = TProof::Open("pod://")
root [1] p->ClearPackages()
root [2] p->UploadPackage(“tutorial/event.par")
root [3] p->EnablePackage("event")
root [4] p->Exec("Event *ev=0")
```

TRY IT OUT

- tutorial/runProof.C
    - Provides useful examples to try out
    - How to run:

```
$ root -l
root [0] .L tutorial/runProof.C+
root [1] runProof(“<action>”,”<url>”)
```

    - Simple example (the same as we already did)

```
root [2] runProof(“simple”,”pod://“)
```

    - h1 analysis example (featuring “feedback”)

```
root [3] runProof(“h1”,”pod://“)
```

    - Event(PAR) example

```
root [4] runProof(“event”,”pod://“)
root [5] runProof(“eventproc”,”pod://“)
```

    - Other actions described in runProof.C

TRY IT OUT

- tutorial/runProof.C
  - Provides useful examples to try out
  - How to run:

```
$ root -l
root [0] .L tutorial/runProof.C+
root [1] runProof(“<action>”,”<url>”)
```

What could be possible?

  - Simple example (the same as we already did)

```
root [2] runProof(“simple”,”pod://”)
```

  - h1 analysis example (featuring “feedback”)

```
root [3] runProof(“h1”,”pod://”)
```

  - Event(PAR) example

```
root [4] runProof(“event”,”pod://”)
root [5] runProof(“eventproc”,”pod://”)
```

  - Other actions described in runProof.C

SUMMARY

- In this tutorial, we have learned
  - How to start PoD server and claim workers
  - How to start PROOF on local session
  - How to run simple queries
  - How to manage PAR

ALICE-SPECIFIC THINGS

Data Staging Request

- Query string:
  - Official Data/MC format

```
Data;Period=<LHCPERIOD>;Variant=[ESDs|AODXXX];Run=<RUNLIST>;Pass=<PASS>

Sim;Period=<LHCPERIOD>;Variant=[ESDs|AODXXX];Run=<RUNLIST>
```

  - Find format

```
Find;BasePath=<BASEPATH>;FileName=<FILENAME>;Anchor=<ANCHOR>;Tree=<TREENAME>;Regexp=<REGEXP>
```

- Request Dataset Staging:

```
root[0] p->RequestStagingDataSet(“QueryString”)
```

ALICE-SPECIFIC THINGS

Data Staging Request

```
Data: alimonitor.cern.ch -> Production Info -> RAW production cycles
MC: alimonitor.cern.ch -> Production Info -> MC production cycles
```

- Query string:
  - Official Data/MC format

```
Data;Period=LHC15g;Variant=ESDs;Run=230292;Pass=pass1

Sim;Period=LHC13d3;Run=195675;Variant=ESD
```

  - Find format

```
Find;BasePath=<BASEPATH>;FileName=<FILENAME>;Anchor=<ANCHOR>;Tree=<TREENAME>;Regexp=<REGEXP>
```

- Request Dataset Staging:

```
root[0] p->RequestStagingDataSet(“Data;Period=LHC15g;Variant=ESDs;Run=230292;Pass=pass1”)
root[1] p->RequestStagingDataSet(“Sim;Period=LHC13d3;Run=195675;Variant=ESD”
```

```
root[0] p->ShowStagingStatusDataSet(“QueryString”,“[Cc|S]”)
root[1] p->CancelStagingDataSet(“QueryString”)
```

REMEMBER

- Documentation about ROOT & PROOF:

  http://root.cern.ch

- PoD User's Guide:

  http://pod.gsi.de

- Direct Support:

  sahn@kisti.re.kr or sang.Un.Ahn@cern.ch

HOPE YOU GET SOME IDEA WHERE TO BEGIN A LONG JOURNEY TO ANALYSIS WORLD

THANK YOU