MPIfR Correlator Report

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Cluster Hardware

Compute Nodes:

60 Dual-Quadcores = 480 Cores (16 GB memory each)

40 computers used for DiFX

Datastream Nodes:

14 Mark5 units (6 Mark5C, 1 Mark5B, 7 Mark5A)

Headnodes

1 Dual Quadcore (16 GB memory)
+ 1 backup system

Storage

5 RAID-6 Units (20 TB each)
5 RAID-6 Units (40 TB each)
1 RAID-6 Unit (8 TB)

total ≈300TB
80 TB reserved for DiFX
(file-based correlation)

Interconnect

Infiniband connection (Cluster interconnect)
2x 1GB Ethernet to Mark5 units

Mark5 Units

Total of 14 Mark5 units (mixed A/B/C flavors)

OS: CentOS 5.5 (= Redhat Enterprise Linux 5.5)
pending upgrade...until playback bug is fixed (Roger ?)

SDK: 9.1

Interconnect: 2 x 1Gb Ethernet

NOTE: OpenMPI can utilize multiple networks automatically (no trunking needed)
- Low-Cost alternative for faster transfer speeds (compared to Infiniband etc.).
- No-Problem with long cable lenghts (Infiniband: < 10m)

Planned additions for this year:

- Switchable PDU for Mark5 units (allows remote power off/on)
- Infiniband (over fibre) connection from Mark5s to cluster

Data transfer speed

Operations switched from using fuseMk5 to native mode in 12/2010:

=> higher playback speed (also more comfort!)

fuseMk5 (1x 1GB ethernet):	500-750 Mb/s
native mode (1x 1Gb ethernet):	≈ 1.0 Gbit/s
native mode (2x 1Gb ethernet):	≈ 1.4 Gbit/s
infiniband:	??? (Walter B. ?)

But: limited by maximum playback rate of the Mark5 Streamstor hardware:

PCI-816XF2 (Mark5A):	1.4 Gb/s
Amazon (Mark5C):	1.6 Gb/s

DiFX operations @ MPIfR

- currently no GUI /database in use (planned within 2011)
- using standard NRAO command-line applications

  mkdaemon
  mk5dir
  mk5control
  mk5erase
  startdifx
  genmachines
  mk5mon
  cpumon
  ....

DiFX operations @ MPIfR

Modifications to the standard NRAO programs
(mostly not yet submitted to the SVN repository ☹)

mk5daemon

--user option

allows execution of system commands from mk5daemon (e.g. mk5dir) with the given user privileges.

--isMk5

forces this machine to be a Mark5 regardless of its hostname

genmachines

properly treat file-based datastreams in creation of machine file

startdifx

run in loop until data is available (overcome „close“ problem)

DiFX operations @ MPIfR

Other planed modifications:

startdifx / genmachines

--use-machines

explictely give DIFX_MACHINES file ,overiding „DIFX_MACHINES“environment. Useful for starting multiple correlations at the same time.

DIFX_MACHINES / genmachines

add more options to DIFX_MACHINES file, e.g.

for file-based correlation, allow certain machines to always serve a particular datastream path.

```
fxmanager     0  0
mark5fx01     0  1
io03          6  0  serves=/data3
io04          5  0  serves=/data4
```

32/64 bit operations

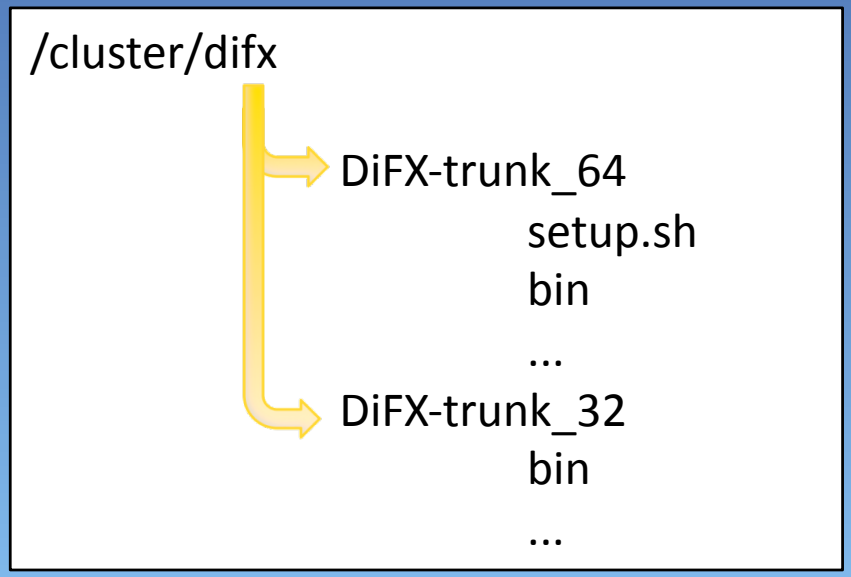
Mixed 32/64-bit operations:

Cluster is running 64-bit
Mark5 machines are running 32-bit (no 64-bit streamstor API by Conduant)

⇒ compile OpenMPI with option `--enable-heterogeneous`

Needs 32-bit and 64-bit versions of DiFX

MPIfR largly follows NRAO scheme:



See presentation
„mixing 32 and 64 bit cluster members"
of Walter B. at:
http://cira.ivec.org/dokuwiki/doku.php/difx/socorro2010/register

32/64 bit operations

Sample setup.sh

```
if [[ `uname --hardware-platform` == "x86_64" ]]; then
        export DIFXBITS=64
        export IPPROOT=/cluster/intel/ipp/6.1.2.051/em64t/
        export OPENMPIROOT=/cluster/openmpi/1.4.3/x86_64/
        export DIFXROOT=/cluster/difx/DiFX-trunk_64
else
        export DIFXBITS=32
        export IPPROOT=/cluster/intel/ipp/6.1.2.051/ia32
        export OPENMPIROOT=/cluster/openmpi/1.4.3/i386/
        export DIFXROOT=/cluster/difx/DiFX-trunk_centos55_sdk91_32
fi

export DIFX_VERSION=DiFX-trunk
export MPIXCC=${OPENMPIROOT}/bin/mpicxx
export PATH=${DIFXROOT}/bin:${OPENMPIROOT}/bin:${PATH}
export PKG_CONFIG_PATH=${DIFXROOT}/lib/pkgconfig:${PKG_CONFIG_PATH}
export LD_LIBRARY_PATH=${DIFXROOT}/lib:${IPPROOT}/sharedlib:${OPENMPIROOT}/lib:$
{LD_LIBRARY_PATH}
export DIFX_MESSAGE_GROUP=224.2.2.1
export DIFX_MESSAGE_PORT=52525
export DIFX_BINARY_GROUP=224.2.2.1
export DIFX_BINARY_PORT=52526
export CALC_SERVER=fxmanager
export DIFX_MACHINES=/cluster/difx/machines
export MARK5_DIR_PATH=/cluster/difx/directories
```

Problems

Main problems encountered during DiFX operations:

1) Hanging Mark5 units

Mark5 computers frequently crash & freeze during correlation
(typically once every few hours).

=> unattended correlation impossible

Crashes occur more frequently in native mode than using fuseMk5
(higher datarates? Larger reads ?)

2) „Invalid data“ on kernels < 2.6.18

First saw this problem in Jan 2011. Degugging and finding kernel-link was time-consuming. Thanks to Roger, problem is now fairly well understood!

3) Problems with data

DiFX is less tolerant towards “weird” data than MK4 hardware correlator.
Occasions were data could be correlated with MK4 but was refused by DiFX.
Requires: Fixing the data by the analysts.

EVN correlators probably see “weird” data more frequently than VLBA.