

# The LWA1 User Computing Facility

## Ver. 1

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# 1 Introduction

The LWA1 User computing facility (UCF) is a six node cluster available to LWA1 users for reducing LWA1 data. The cluster is located in two racks in the old correlator room in the VLA control building. This location was selected in order to decrease the turn around time for data processing by moving the processing equipment closer to the data. This document describes the hardware setup of the cluster and provides information about user access.

## 2 Available Hardware and Software

Each of the nodes consists of:

- an Intel(R) Core(TM) i7-3930K six core CPU with a clock rate of 3.20GHz;
- 32 GB of RAM;
- an Nvidia GeForce GTX6800 graphics card with
  - 2 GB of RAM,
  - 1536 CUDA cores, and
  - CUDA compute capability 3.0;
- an Nvidia Tesla C2075 graphics card with
  - 6 GB of RAM,
  - 448 CUDA cores, and
  - CUDA compute capability 2.0;
- a four port 10 GbE fiber card; and
- four 3 TB hard drives.

Each node runs the desktop version of Ubuntu 12.04 LTS<sup>1</sup> and has a variety of software installed by default, including ATLAS, FFTW, PRESTO, LSL, and OpenMPI. Users requiring additional software to be installed on the nodes should contact the cluster administrator, Jayce Dowell, via e-mail.

## 3 Networking

The UCF nodes are physically connected to each other via 10Gbase-SR 10 GbE fiber modules and 50/125 multimode fiber patch cables. The topology of the network is based on a torus and is either two dimensional for the current complement of four nodes or one dimensional for the expected complement of six nodes. In order to resolve loops within this topology the spanning tree protocol is used. The cluster is connected to the LWA1 Monitor and Control (MCS) 10.1.1.\* network via a 10 GbE connection to the shelter. See [1] for details of the network configuration.

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<sup>1</sup><http://releases.ubuntu.com/precise/>

## 4 Storage

Data storage for the UCF is divided into three tiers: user-specific storage, temporary local storage, and massive data storage. The first tier is implemented as an NFS mounted home directory available on all of the nodes. The total storage for this mount is 2.7 TB which is shared among all users. This mount point is intended to store the user's personal files as well as any final data products waiting to be transferred out of the cluster. The second tier is implemented to be a temporary "scratch space" where users of the node can store intermediate data products that require further manipulation. This area is mounted as `/data/local` on each node and is world writable for all users of that particular node. The final tier of storage is a distributed Gluster file system<sup>2</sup> with a total capacity, currently, of 22 TB. This file system, mounted on `/data/network`, is constructed to be both distributed, i.e., files are distributed across the various node that are part of the Gluster file system, and striped, i.e., any particular file is striped across two nodes. This arrangement allows for more efficient access of the large data files that are to be stored on this file system. Since this file system is intended to only store raw data it is world readable write permission is restricted to the LWA1 operator.

Data and MCS0030 metadata file [2] files are copied over to the Gluster file system through mount points on each of the five data recorders. The copying process is initiated and monitored by the LWA1 operator on duty. For details of the management of data files see [3]. It should be noted that there are currently no quotas or file age limits on either the `/data/local` or `/data/network` drives. Rather, it is the responsibility of the users to ensure that they observe common courtesy when using the system and avoid excessive use of these data spaces.

## 5 User Management and Access

Users of the UCF are given individual unprivileged accounts which work on all nodes via a light-weight directory access protocol (LDAP) server running on node #1. All remote access to the cluster will be handled through secure shell (SSH) sessions. Since the cluster is located within the MCS network, users of the cluster will first need to connect to `lwalab.phys.unm.edu` and use an OpenVPN<sup>3</sup> tunnel to access the cluster nodes. The cluster LDAP information will also be available on `lwalab.phys.unm.edu` so that users will only need one set of credentials to access the cluster.

Time on the cluster is allocated based on requests in the LWA1 observing proposals. See [3] for details on how time is requested. Users needing to copy data off of the cluster should contact the cluster administrator to schedule a window for the copy. This is required to ensure that data transfers do not interfere with the operation of LWA1 or other user requests.

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<sup>2</sup><http://www.gluster.org/>

<sup>3</sup><http://openvpn.net/index.php/open-source/overview.html>

## 6 Document History

- Version 1 (Nov 25, 2012): First version.

## References

- [1] J. Craig et al., “LWA1 Local Area Network Configuration”, Ver. 7.0, MCS Memo No. 33, Oct 25, 2012.
- [2] S. Ellingson, “LWA Station-Level Observing Procedure and Associated Metadata”, Ver. 5.0, MCS Memo No. 30, Apr 13, 2011.
- [3] G. Taylor et al., “LWA Data Management”, Ver. 2.0, LWA Memo No. 177, Nov 20, 2012.