

LASER INTERFEROMETER GRAVITATIONAL WAVE OBSERVATORY  
- LIGO -  
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<b>Penn State University Tier 2 Center Description</b>		
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**Abstract**

This note describes the hardware configuration of the Penn State Tier 2 center and the assignment of hardware to different center functions.

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**1 Introduction**

This note describes the hardware configuration of the Penn State Tier 2 LIGO Scientific Collaboration Data Analysis Center.

Hardware in the Penn State Center is distributed assigned to one of five functions: computing, storage, administration and cluster control, development, and networking. This report is organized according to function, with the hardware assigned to each function described in the appropriate section.

These computing resources are co-funded by the iVDGL award (\$385,895), the Penn State Center for Gravitational Wave Physics (CGWP, \$99,554), the Penn State University LSC Research Group (PSURG, \$68,941), and matching funds provided by Penn State University (\$104,011). In addition, the Penn State University Office of Graduate Education and Research Services (GEARS) is providing cooling, conditioned-power, machine-room floor space, and system administration and configuration assistance.

**2 Compute nodes**

The Penn State Center is equipped with 156 dual processor compute nodes with two different speeds. The compute nodes are described in table 1 below.

**3 Storage**

Storage will be provided for the cluster by a farm of nine linux servers, each fronting two SCSI-attached 14 bay enclosures for SCSI disks.

Table 1: Configuration of the Penn State Center compute nodes.

Processor	Dual Intel Xeon	
Speed (GHz)	2.8	3.06
Memory	2 GB	2 GB
Front Side Bus	533 MHz	533 MHz
Disk	36GB Ultra 320 SCSI	
Form factor	1U	1U
# nodes	128	28
Vendor	Sun	Dell

Table 2: Configuration of nodes dedicated to system administration, monitoring and cluster control.

Processor	Dual Intel Xeon	
Speed (GHz)	2.4 GHz	
Memory	2 GB	
Front Side Bus	400 MHz	
Disks	3x36GB Ultra 320 SCSI	
# nodes	2	
Vendor	Dell	

Each enclosure will be fully populated by 146GB 10K RPM Ultra 320 SCSI drives configured as RAID 5 for a total of 34.2TB usable RAID 5 for the farm. Each linux server will act as a front-end for a pair of enclosures, serviced by a single dual-channel SCSI controller. Each server will be identical to the 3.06 GHz compute nodes described in table 1 *except* that the memory per farm node is 4GB.

The storage farm is expandable either by adding additional controllers and enclosures to the nodes or by adding additional nodes, controllers and enclosures.

## 4 Network

The compute nodes and storage farm will reside on a single Alcatel 7000 family gigabit switch. The switch has a maximum capacity of 192 gigabit ports on 16 blades, with each blade providing 12 gigabit ports. Blades have been purchased for 168 gigabit ports.

## 5 System administration, monitoring and cluster control

System administration, monitoring and cluster control, and development work will take place on dedicated equipment. System administration, monitoring and cluster control will take make use of the equipment described in table 2.

Table 3: Configuration of nodes available for system development and software testing.

Processor	Intel Xeon
Speed (GHz)	2.4 GHz
Memory	1 GB
Front Side Bus	400 MHz
Disk	36GB Ultra 320 SCSI
# nodes	8
Vendor	Dell
Processor	Dual Intel Xeon
Speed (GHz)	2.4 GHz
Memory	2 GB
Front Side Bus	400 MHz
Disk	3x36GB Ultra 320 SCSI
# nodes	2
Vendor	Dell

## 6 Development

A small set of equipment, described in table 3, is set-aside for development work, including software testing prior to deployment on the development cluster. The exact configuration of these nodes will vary as processors, disks and memory are reallocated among the nodes to permit different hardware configurations to be tested.