The Keck telescopes, located at one of the world’s premier sites for astronomy, were the first of a new generation of very large ground-based optical/infrared telescopes. The first Keck telescope began science operations in May of 1993, and the second in October of 1996. The components of the telescopes and control systems are more than 15 years old. The upgrade to the control systems of the telescopes consists of mechanical, electrical, software and network components with the overall goals of improving performance, increasing reliability, addressing serious obsolescence issues and providing a knowledge refresh. This poster will detail the implementation and testing for the Keck II telescope.

A switching solution has been implemented for both hardware and software systems to allow quick and easy switching between the operational and upgraded control systems.

**Switching Solution**
- General Operations Network (operators, instruments, other subsystems)
  - Switched VLANs
  - CA Gateway client
  - VLAN 1
  - VLAN 2
  - Intra Subsystem Network

**Hardware Switching Solution**
- Cables to/from DCS field hardware
- Cables to/from DCS control computers
- Switching Solution
  - Bypassing signals
  - Switched signals
- Cables to/from TCS field hardware
- Cables to/from TCS control computers
  - Bypassing signals

**Software Switching Solution**
- Telescope Control System
  - Telescope mounts
  - Dome/Shutter positions
  - Facility rotators
  - Secondary mirror
- Adaptive Optics
- Laser & LTCS
- Observing Assistants
- Seeing Limited Instruments

**Testing**

**Keck II Offset Moves Settling Times**

<table>
<thead>
<tr>
<th>Telescope Moves (arcsec)</th>
<th>1</th>
<th>5</th>
<th>10</th>
<th>50</th>
<th>100</th>
<th>1000</th>
<th>10000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time Requirement (sec)</td>
<td>0.3</td>
<td>1.0</td>
<td>1.0</td>
<td>3.0</td>
<td>3.0</td>
<td>10.0</td>
<td>20.0</td>
</tr>
</tbody>
</table>

**Levels of Testing**
- Developer
- Hardware Checkout
- Unit Testing
- Functional Unit Testing
- System/Acceptance Testing

**Hardware Switching Solution**
- Simple procedure
- Three switches
- A couple cables
- Implemented on a subsystem by subsystem basis
- Freedom in testing

**Software Switching Solution**
- Change port number
- Run in parallel with current system day and night

**Successes**
- Backwards compatibility
  - Didn’t have to re-validate existing client applications

**Challenges**
- Coordinating with other projects
  - Operations has highest priority
  - May get bumped by other projects
- On-sky testing
  - Scheduled months in advance
  - Need to ensure readiness
  - Weather

**Current Status**

**Keck II**
- All subsystems fully integrated and tested
- Successful on-sky tests completed
- Continuing fine-tuning of servo

**Keck I**
- Hardware installation to be completed in Nov. 2015
- Operations Readiness Review Dec. 2015
- Integration and testing expected by Mar. 2016