



**Upgrading to the Solaris™ 10 10/08 OS
for SPARC® Platforms
and From UFS Boot to ZFS Boot**

*A BigAdmin Community Submission by
Haim Tzadok and Cyril Plisko, Grigale Ltd.
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Introduction

ZFS boot is a unique feature introduced in the Solaris™ 10 10/08 Operating System (also known as "Update 6").

To a novice system administrator, performing a fresh install of the Solaris 10 10/08 OS might seem easier than upgrading the Solaris OS and moving from the Solaris 10 UFS root file system to ZFS boot, but we will explain the process.

This paper shows how to upgrade from the Solaris 10 5/08 release to Solaris 10 10/08 (for SPARC® platforms), using the Solaris Live Upgrade process, while manually creating a ZFS root pool, copying the UFS root file system into the ZFS root pool, and activating ZFS mirroring.

Note: This procedure has been successfully tested on the Solaris 10 5/08 and Solaris 10 8/07 releases, but not on previous updates.

System Requirements

To perform this upgrade, you will need the following:

1. DVD or ISO file: Solaris 10 10/08 OS for SPARC platforms
2. Two system disks, one occupying the current Solaris 10 UFS root file system, and another one free for use

Prerequisites

Before you perform the upgrade, we recommend that you do the following:

- Make sure you have the most recently updated patch list by consulting the [SunSolve web site](#). Otherwise, the upgrade process might encounter problems. For more information, search for info doc 72099 on the SunSolve™ site.
- Consolidate all your /, /var, and /opt file systems to one single file system.
- If you use Solaris Volume Manager for mirroring, it is recommended that you remove all Solaris Volume Manager configuration.
- Perform a full backup of your root file system for safety reasons.

List of Steps

Here are the steps you will follow to perform the upgrade:

- Step 1: Installing Solaris Live Upgrade Packages on the Solaris 10 5/08 Boot Environment
- Step 2: Creating Boot Environment Called sol10u6_stage1 (Still on UFS)
- Step 3: Using Solaris Live Upgrade to Upgrade sol10u6_stage1 to Solaris 10 10/08 OS
- Step 4: Activating sol10u6_stage1
- Step 5: Creating Boot Environment Called sol10u6_stage2 on ZFS Pool (rpool)
- Step 6: Activating sol10u6_stage2
- (Optional) Step 7: Activating ZFS Mirroring

Flowchart and Diagram of the Process

The upgrade and file system migration can be visualized as shown in Figure 1 and Figure 2.

Figure 1: Flowchart of the Process

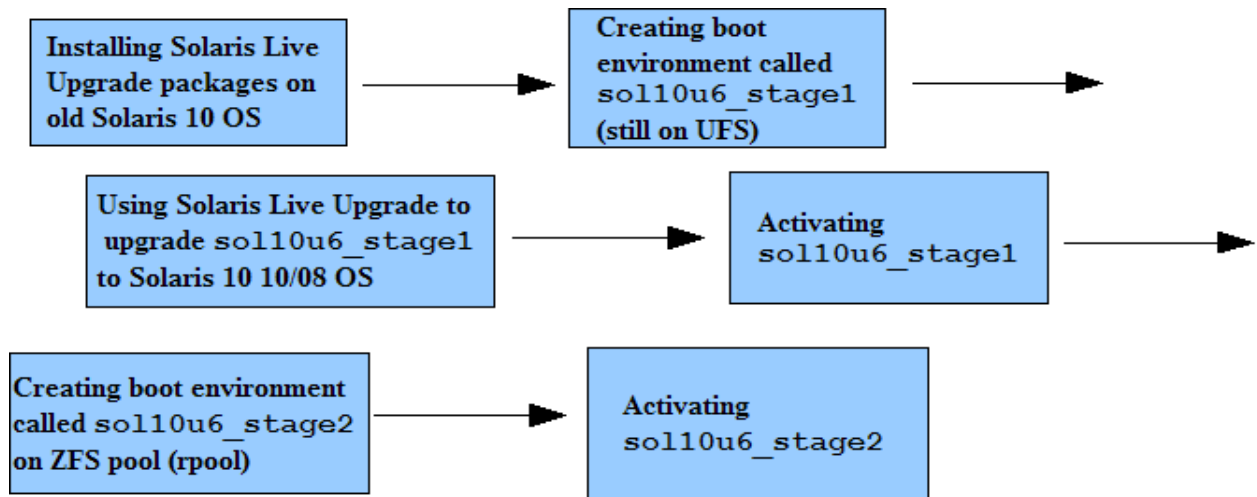
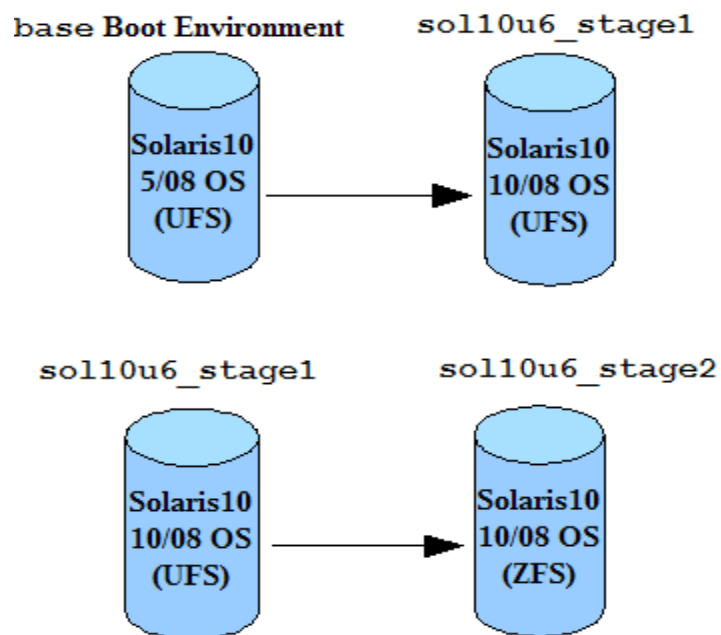


Figure 2: Diagram of the Process



Step 1: Installing Solaris Live Upgrade Packages on the Solaris 10 5/08 Boot Environment

Solaris Live Upgrade (LU) packages are available on the Solaris 10 10/08 OS for SPARC platforms DVD or ISO file.

Mount your DVD or ISO file and install the packages by typing:

```
/cdrom/cdrom0/s0/installer
```

If you have access to X-Server, a GUI window is opened; otherwise, the process continues in CLI mode.

Example CLI installation:

```
Java Accessibility Bridge for GNOME loaded.
Solaris Web Start will assist you in installing software for Solaris 10
Software.
<Press ENTER to continue> ENTER
IMPORTANT NOTICE
Patches Needed to Run Solaris Live Upgrade
Correct operation of Solaris Live Upgrade requires that a limited set of patch
revisions be installed for a given OS version.
Before installing or running Live Upgrade, you are required to install a
limited set of patch revisions. Make sure you have the most recently updated
patch list by consulting sunsolve.sun.com. Search for the info doc 72099 on the
SunSolve(tm) web site.
Live Upgrade may fail to work properly if the latest limited set of patch
revisions are not installed on this system.
<Press ENTER to continue> ENTER
Please select the type of install to perform from the following choices:
Typical - Software will be installed with the most common
options. Recommended for most users.
Custom - You may choose the options you want to install.
Recommended for advanced users.
1. Typical
2. Custom
What would you like to do [1]?
Checking disk space.

The following items will be installed:
Product: Live Upgrade
Location: /
Size: 2.49 MB
-----
Live Upgrade (root) 1.27 MB
Live Upgrade (usr) 1.21 MB
Live Upgrade (config) 17.26 KB
Ready to Install
1. Install Now
2. Start Over
3. Exit Installation
What would you like to do [1]? ENTER
```

Step 2: Creating Boot Environment Called `sol10u6_stage1` (Still on UFS)

As a first stage, upgrade to the Solaris 10 10/08 OS on a UFS file system.

Your current Solaris 10 5/08 boot environment will be called `base`. Your new Solaris 10 10/08 boot environment on a UFS file system will be called `sol10u6_stage1`.

Copy the Volume Table of Contents (VTOC) of the current root disk to the free disk.

For example, if `c1t1d0s2` is the root disk and `c1t2d0s2` is the free disk, type:

```
prtvtoc /dev/rdisk/c1t1d0s2 | fmthard -s - /dev/rdisk/c1t2d0s2
```

Create `base` and `sol10u6_stage1` boot environments by typing:

```
lucreate -c base -m /:/dev/dsk/c1t2d0s0:ufs -m -:/dev/dsk/c1t2d0s1:swap -n sol10u6_stage1
```

This step might take a substantial amount of time depending on the capacity of your system.

Output example:

```
(root@b1000: /)# lucreate -c base -m /:/dev/dsk/c1t2d0s0:ufs -m -:/dev/dsk/c1t2d0s1:swap -n sol10u6_stage1
Discovering physical storage devices
Discovering logical storage devices
Cross referencing storage devices with boot environment configurations
Determining types of file systems supported
Validating file system requests
Preparing logical storage devices
Preparing physical storage devices
Configuring physical storage devices
Configuring logical storage devices
Analyzing system configuration.
No name for current boot environment.
Current boot environment is named <base>.
Creating initial configuration for primary boot environment <base>.
The device </dev/dsk/c1t1d0s0> is not a root device for any boot environment; cannot get BE ID.
PBE configuration successful: PBE name <base> PBE Boot Device </dev/dsk/c1t1d0s0>.
Comparing source boot environment <base> file systems with the file
system(s) you specified for the new boot environment. Determining which
file systems should be in the new boot environment.
Updating boot environment description database on all BE s.
Searching /dev for possible boot environment filesystem devices
```

Continued output example:

```
Updating system configuration files.
The device </dev/dsk/c1t2d0s0> is not a root device for any boot environment; cannot get BE ID.
Creating configuration for boot environment <sol10u6_stage1>.
Source boot environment is <base>.
Creating boot environment <sol10u6_stage1>.
Creating file systems on boot environment <sol10u6_stage1>.
Creating <ufs> file system for </> in zone <global> on </dev/dsk/c1t2d0s0>.
Mounting file systems for boot environment <sol10u6_stage1>.
Calculating required sizes of file systems for boot environment <sol10u6_stage1>.
Populating file systems on boot environment <sol10u6_stage1>.
Checking selection integrity.
Integrity check OK.
Populating contents of mount point </>.
Copying.
Creating shared file system mount points.
Creating compare databases for boot environment <sol10u6_stage1>.
Creating compare database for file system </>.
Updating compare databases on boot environment <sol10u6_stage1>.
Making boot environment <sol10u6_stage1> bootable.
Population of boot environment <sol10u6_stage1> successful.
Creation of boot environment <sol10u6_stage1> successful.
```

Check that you have two boot environments by typing:

```
lustatus
```

Output example:

```
(root@b1000: /)# lustatus
Boot Environment      Is      Active Active   Can      Copy
Name                  Complete Now    On Reboot Delete Status
-----
base                   yes      yes    yes      no       -
sol10u6_stage1        yes      no     no       yes      -
```


Step 3: Using Solaris Live Upgrade to Upgrade sol10u6_stage1 to Solaris 10 10/08 OS

Perform the Solaris Live Upgrade process to upgrade sol10u6_stage1 by typing:

```
luupgrade -u -n sol10u6_stage1 -s /net/pronto/export/install/sparc/s10u6
```

Output example:

```
(root@b1000: /)# luupgrade -u -n sol10u6_stage1 -s /net/pronto/export/install/sparc/s10u6/

42092 blocks
miniroot filesystem is <lofs>
Mounting miniroot at </net/pronto/export/install/sparc/s10u6//Solaris_10/Tools/Boot>
Validating the contents of the media </net/pronto/export/install/sparc/s10u6/>.
The media is a standard Solaris media.
The media contains an operating system upgrade image.
The media contains <Solaris> version <10>.
Constructing upgrade profile to use.
Locating the operating system upgrade program.
Checking for existence of previously scheduled Live Upgrade requests.
Creating upgrade profile for BE <sol10u6_stage1>.
Determining packages to install or upgrade for BE <sol10u6_stage1>.
Performing the operating system upgrade of the BE <sol10u6_stage1>.
CAUTION: Interrupting this process may leave the boot environment unstable
or unbootable.
Upgrading Solaris: 100% completed
Installation of the packages from this media is complete.
Updating package information on boot environment <sol10u6_stage1>.
Package information successfully updated on boot environment <sol10u6_stage1>.
Adding operating system patches to the BE <sol10u6_stage1>.
The operating system patch installation is complete.
INFORMATION: The file </var/sadm/system/logs/upgrade_log> on boot
environment <sol10u6_stage1> contains a log of the upgrade operation.
INFORMATION: The file </var/sadm/system/data/upgrade_cleanup> on boot
environment <sol10u6_stage1> contains a log of cleanup operations required.
WARNING: <4> packages failed to install properly on boot environment <sol10u6_stage1>.
INFORMATION: The file </var/sadm/system/data/upgrade_failed_pkgadds> on
boot environment <sol10u6_stage1> contains a list of packages that failed
to upgrade or install properly.
INFORMATION: Review the files listed above. Remember that all of the files
are located on boot environment <sol10u6_stage1>. Before you activate boot
environment <sol10u6_stage1>, determine if any additional system
maintenance is required or if additional media of the software
distribution must be installed.
The Solaris upgrade of the boot environment <sol10u6_stage1> is partially complete.
```

Note: The reason for this warning is that patching a system from earlier updates sometimes brings some packages to a higher revision than the revision that comes on Solaris 10 10/08 OS. In such a case, the updated packages will not be upgraded, since they are already in a higher revision.

Step 4: Activating sol10u6_stage1

To activate sol10u6_stage1, type:

```
luactivate sol10u6_stage1  
init 6
```

Step 5: Creating Boot Environment Called sol10u6_stage2 on ZFS Pool (rpool)

Now we need to delete the base boot environment by typing:

```
ludelete base
```

Output example:

```
(root@b1000: Product)# ludelete base  
Determining the devices to be marked free.  
Updating boot environment configuration database.  
Updating boot environment description database on all BEs.  
Updating all boot environment configuration databases.  
Boot environment <base> deleted.
```

Now, we need to create a new VTOC (partition table) to the first disk, so it will have only partition 0, which is a copy of partition 2 (the backup partition). All other partitions should be empty.

We will do this by typing the following:

```
format
```

Follow the instructions shown in the following output examples:

```
(root@b1000: /)# format
Searching for disks...done

AVAILABLE DISK SELECTIONS:
  0. c1t1d0 <SUN36G cyl 24620 alt 2 hd 27 sec 107>
    /pci@8,600000/SUNW,qlc@4/fp@0,0/ssd@w2100002037e3b3af,0
  1. c1t2d0 <SUN36G cyl 24620 alt 2 hd 27 sec 107>
    /pci@8,600000/SUNW,qlc@4/fp@0,0/ssd@w2100002037b2d617,0
Specify disk (enter its number): 0 ENTER
p -> ENTER p -> ENTER

partition> modify
Select partitioning base:
  0. Current partition table (original)
  1. All Free Hog
Choose base (enter number) [0]? 1

Part  Tag  Flag  Cylinders    Size      Blocks
  0   root  wm    0          0    (0/0/0)      0
  1   swap  wu    0          0    (0/0/0)      0
  2  backup  wu    0 - 24619   33.92GB (24620/0/0) 71127180
  3 unassigned  wm    0          0    (0/0/0)      0
  4 unassigned  wm    0          0    (0/0/0)      0
  5 unassigned  wm    0          0    (0/0/0)      0
  6   usr  wm    0          0    (0/0/0)      0
  7 unassigned  wm    0          0    (0/0/0)      0
```

Continued output example:

```
Do you wish to continue creating a new partition
table based on above table[yes]? ENTER
Do you wish to continue creating a new partition
table based on above table[yes]?
Free Hog partition[6]? 0
Enter size of partition '1' [0b, 0c, 0.00mb, 0.00gb]: 0
Enter size of partition '3' [0b, 0c, 0.00mb, 0.00gb]: 0
Enter size of partition '4' [0b, 0c, 0.00mb, 0.00gb]: 0
Enter size of partition '5' [0b, 0c, 0.00mb, 0.00gb]: 0
Enter size of partition '6' [0b, 0c, 0.00mb, 0.00gb]: 0
Enter size of partition '7' [0b, 0c, 0.00mb, 0.00gb]: 0

Part  Tag  Flag  Cylinders    Size    Blocks
0  root  wm   0 - 24619  33.92 GB (24620/0/0) 71127180
1  swap  wu    0        0    (0/0/0)      0
2  backup wu   0 - 24619  33.92 GB (24620/0/0) 71127180
3 unassigned wm    0        0    (0/0/0)      0
4 unassigned wm    0        0    (0/0/0)      0
5 unassigned wm    0        0    (0/0/0)      0
6  usr  wm    0        0    (0/0/0)      0
7 unassigned wm    0        0    (0/0/0)      0

Okay to make this the current partition table[yes]? ENTER
Enter table name (remember quotes): test

Ready to label disk, continue? y

partition> q -> ENTER q -> ENTER
```

Now, confirm that the current ZFS pool supports the ZFS boot feature by identifying the `bootfs` pool property in the `zpool upgrade -v` output:

```
zpool upgrade -v
```

Output example:

```
(root@b1000: /)# zpool upgrade -v
This system is currently running ZFS pool version 10.
The following versions are supported:

VER  DESCRIPTION
-----
1  Initial ZFS version
2  Ditto blocks (replicated metadata)
3  Hot spares and double parity RAID-Z
4  zpool history
5  Compression using the gzip algorithm
6  bootfs pool property
7  Separate intent log devices
8  Delegated administration
9  refquota and refreservation properties
10 Cache devices
For more information on a particular version, including supported releases, see:
http://www.opensolaris.org/os/community/zfs/version/N
Where 'N' is the version number.
```

If you see that you have the `bootfs` pool property, you can proceed to create a root pool by typing:

```
zpool create rpool c1t1d0s0
```

Check that `rpool` was created by typing:

```
zpool list
```

Output example:

```
(root@b1000: /)# zpool list
NAME      SIZE  USED  AVAIL  CAP  HEALTH  ALTROOT
rpool    33.8G  111K  33.7G   0%  ONLINE  -
```

Proceed to create the Solaris Live Upgrade environment on `rpool` by typing:

```
lucreate -c sol10u6_stage1 -n sol10u6_stage2 -p rpool
```

Output example:

```
(root@b1000: /)# lucreate -c sol10u6_stage1 -n sol10u6_stage2 -p rpool
Analyzing system configuration.
Comparing source boot environment <sol10u6_stage1> file systems with the
file system(s) you specified for the new boot environment. Determining
which file systems should be in the new boot environment.
Updating boot environment description database on all BE s.
Updating system configuration files.
The device </dev/dsk/c1t1d0s0> is not a root device for any boot environment; cannot get BE ID.
Creating configuration for boot environment <sol10u6_stage2>.
Source boot environment is <sol10u6_stage1>.
Creating boot environment <sol10u6_stage2>.
Creating file systems on boot environment <sol10u6_stage2>.
Creating <zfs> file system for </> in zone <global> on <rpool/ROOT/sol10u6_stage2>.
Populating file systems on boot environment <sol10u6_stage2>.
Checking selection integrity.
Populating contents of mount point </>.
Copying.
Creating shared file system mount points.
Creating compare databases for boot environment <sol10u6_stage2>.
Creating compare database for file system </rpool/ROOT>.
Creating compare database for file system </>.
Updating compare databases on boot environment <sol10u6_stage2>.
Making boot environment <sol10u6_stage2> bootable.
Creating boot_archive for /.alt.tmp.b-oL.mnt
updating /.alt.tmp.b-oL.mnt/platform/sun4u/boot_archive
Population of boot environment <sol10u6_stage2> successful.
Creation of boot environment <sol10u6_stage2> successful.
```

Step 6: Activating sol10u6_stage2

Check the status of sol10u6_stage2 by typing:

```
lustatus
```

Output example:

```
(root@b1000: /)# lustatus
Boot Environment      Is   Active Active   Can   Copy
Name                  Complete Now   On Reboot Delete Status
-----
sol10u6_stage1        yes  yes  yes    no    -
sol10u6_stage2        yes  no   no     yes   -
```

If everything is OK, activate sol10u6_stage2 by typing:

```
luactivate sol10u6_stage2
```

```
init 6
```

After performing the reboot, check to see that your system is indeed using ZFS boot by typing:

```
zpool list
```

```
zfs list
```

Output example:

```
(root@b1000: /)# zpool list
NAME    SIZE  USED  AVAIL  CAP  HEALTH  ALTROOT
rpool  33.8G  11.1G  22.6G   32%  ONLINE  -
(root@b1000: /)# zfs list
NAME                                USED  AVAIL  REFER  MOUNTPOINT
rpool                               15.0G  18.2G   21.5K  /rpool
rpool/ROOT                          9.12G  18.2G    18K  /rpool/ROOT
rpool/ROOT/sol10u6_stage2           9.12G  18.2G   9.12G  /
rpool/dump                          2.01G  18.2G   2.01G  -
rpool/swap                          3.91G  22.1G    16K  -
```

Now you have your system upgraded to the Solaris 10 10/08 OS with ZFS boot.

(Optional) Step 7: Activating ZFS Mirroring

After checking that everything is running and working, delete the old boot environment, `sol10u6_stage1`, by typing:

```
ldelete sol10u6_stage1
```

Output example:

```
Determining the devices to be marked free.
Updating boot environment configuration database.
Updating boot environment description database on all BEs.
Updating all boot environment configuration databases.
Boot environment <sol10u6_stage1> deleted.
```

If you want to activate mirroring, copy the first disk's VTOC to the second disk by typing:

```
prtvtoc /dev/rdisk/clt1d0s2 | fmthard -s - /dev/rdisk/clt2d0s2
```

Add `clt2d0s0` to the `rpool` pool by typing:

```
zpool attach rpool clt1d0s0 clt2d0s0
```

Now check that `rpool` is in the mirror state by typing:

```
zpool status
```

Output example:

```
(root@b1000: /)# zpool status
pool: rpool
state: ONLINE
status: One or more devices is currently being resilvered. The pool will
        continue to function, possibly in a degraded state.
action: Wait for the resilver to complete.
scrub: resilver in progress for 0h0m, 2.36% done, 0h25m to go
config:

    NAME      STATE    READ WRITE CKSUM
    rpool     ONLINE    0   0   0
      mirror  ONLINE    0   0   0
        c1t1d0s0 ONLINE    0   0   0
        c1t2d0s0 ONLINE    0   0   0

errors: No known data errors
```

Wait for the resilvering (copy process) to finish.

In order to boot from the second disk, create a ZFS boot block under the second disk by typing:

```
installboot -F zfs /usr/platform/`uname -i`/lib/fs/zfs/bootblk /dev/rdisk/c1t2d0s0
```

To allow OpenBoot PROM to boot from the first and the second disk, you need to update the `boot-device` variable. In the following example, we consider `disk1` and `disk2` to be device aliases of `c1t1d0s2` and `c1t2d0s2`, respectively.

To update the OpenBoot PROM `boot-device` variable from the Solaris environment, type:

```
eeeprom "boot-device=disk1 disk2"
```

To update the OpenBoot PROM `boot-device` variable from OpenBoot PROM ok prompt, type:

```
ok> setenv boot-device disk1 disk2
```

Now you have a mirror configuration on your system using ZFS.

About the Authors

Haim Tzadok and Cyril Plisko are the owners of Grigale Ltd., a software firm specializing in Solaris and OpenSolaris administration, development and training. The authors participate in many OpenSolaris communities. They can be reached at: [info at grigale dot com](mailto:info@grigale.com).

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