



# Oracle Solaris

Operating Systems Design  
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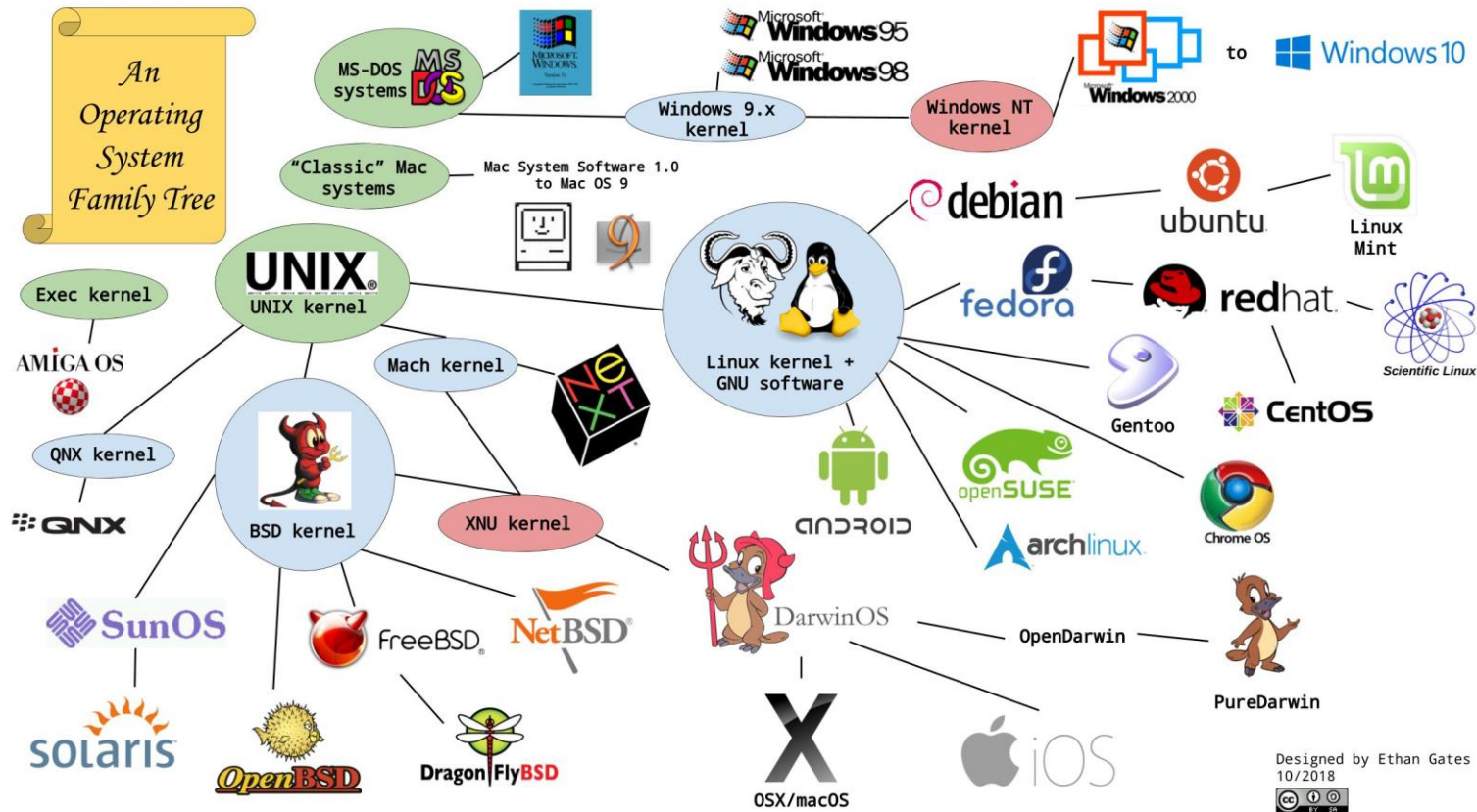
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# What is Oracle Solaris?

- Solaris is a Unix-like OS originally developed by Sun Microsystems as a successor to SunOS.
- Solaris is an officially approved Unix system and works on SPARC and X86 architectures for servers and workstations.
- Solaris superseded SunOS in 1993.
- Became known for its scalability and for originating many innovative features such as Dtrace, ZFS, and Time Slider.



An  
Operating  
System  
Family Tree



# Solaris vs Linux

	<b>Linux</b>	<b>Solaris</b>
<b>Used for</b>	Mobile phones and embedded tablets	Service management
<b>Developed with</b>	C	C and C++
<b>Throughput</b>	Linux has decent throughput	Solaris has an excellent throughput
<b>License Required</b>	Open-source OS with no such requirement	Licensed after Oracle purchased Sun Microsystems
<b>Installation</b>	Simple with Kickstart Installation	Requires an automated installer before installing the OS
<b>Support</b>	Wide support with regular updates	Software updates and is released in batch
<b>Management</b>	Does not have a management facility	System Management Facility (SMF)

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# History of Solaris



## Solaris

- *Originally proprietary software 1992-2004*
- *OpenSolaris - Sun Microsystems released the codebase under the CDDL license 2005-2010*



## Oracle Solaris

- *Oracle acquisition & discontinue OpenSolaris 2010-present*
- *Oracle discontinued providing public updates to source code of Solaris kernel*



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# Platforms



- Initially targeted Sun's SPARC hardware architecture and later expanded support to other hardware platforms
- Uses a common code base that supports SPARC and x86 (Solaris 10 designed with AMD64 in mind)
- Very competent for symmetric multiprocessing (SMP)
- Scalability, interoperability, and portability are advantages of Solaris
- Stands out for having a binary interface application (ABI) which runs the software on any OS that has an identical microprocessor architecture
- Capable of running on different devices, even if they belong to large environments





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# Features

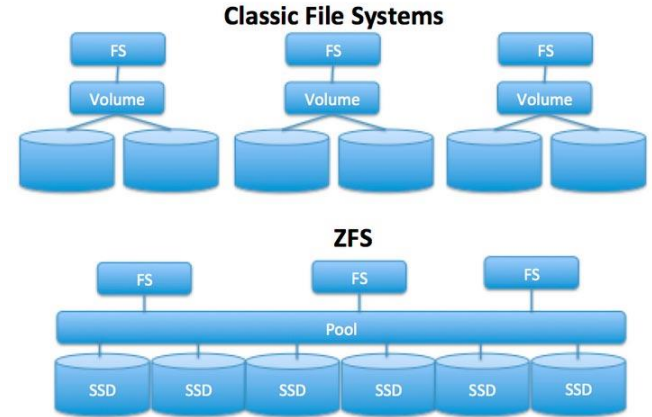
- Robust fault management capabilities, ensuring system remains stable in the face of hardware failures
- The ABI leads to decreased costs of software development, faster landing of products in markets, reduced costs of conversion and more
- Widely used in enterprise computing – large data centers and high-performance computing environments
- Provides advanced virtualization technologies that allow multiple OS and applications to run on a single physical server
- Has many tools for network management and monitoring
- Support for file systems like ZFS for advanced data protection and management capabilities and the ability to manage large storage arrays



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# ZFS

- Began as part of the Solaris OS version 10
- Combines features of a file system and a volume manager
- Uses snapshots to track changes made to the file system
- Snapshot is the original version of the file system and live filesystem contains the changes made since snapshot was taken
- No additional space is used. As new data is written, new blocks are allocated
- Snapshots can be cloned to form new independent file systems
- Has the ability to take a pool snapshot (called a checkpoint) which allows rollback of operations that affect the file structure





## ❖❖ Demo - Snapshots

1. Create zpool
2. Create ZFS file system in pool
3. Set properties

The screenshot shows a terminal window titled "Sun Solaris 10 1/13 [Running]" and "Terminal". The terminal displays the following commands and their outputs:

```
# zpool list
NAME      SIZE  ALLOC   FREE   CAP  HEALTH  ALTROOT
mypool    9.94G   210K   9.94G   0%   ONLINE  -
rpool    31.8G   7.21G   24.5G   22%   ONLINE  -

# zfs create
missing filesystem argument
For more info, run: zfs help create

# zfs create mypool
cannot create 'mypool': missing dataset name

# zfs create mypool/myfs
cannot create 'mypool/myfs': dataset already exists

# zfs set quota=10G mypool/myfs

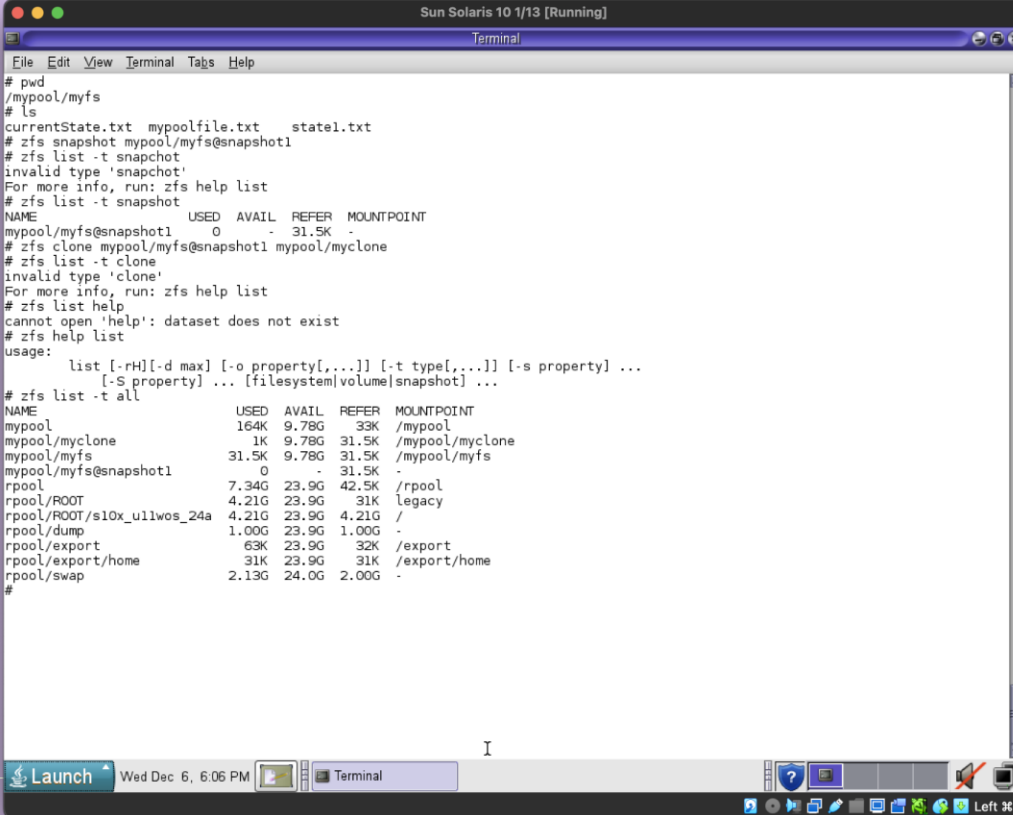
# zfs list
NAME                                USED   AVAIL   REFER  MOUNTPOINT
mypool                             135K   9.78G   32K    /mypool
mypool/myfs                        31K    9.78G   31K    /mypool/myfs
rpool                             7.34G   23.9G   42.5K   /rpool
rpool/ROOT                        4.21G   23.9G   31K    legacy
rpool/ROOT/s10x_u1lwos_24a        4.21G   23.9G   4.21G   /
rpool/dump                        1.00G   23.9G   1.00G   -
rpool/export                      63K    23.9G   32K    /export
rpool/export/home                  31K    23.9G   31K    /export/home
rpool/swap                         2.13G   24.0G   2.00G   -

#
```

The terminal window is part of a desktop environment with a taskbar at the bottom showing "Launch", "Wed Dec 6, 5:49 PM", and "Terminal". The system tray on the right includes icons for help, network, and other system utilities.

# \* Demo - Snapshots

1. Create files
2. Take snapshot
3. List snapshots
4. Create a clone from snapshot (writable copy)
5. List ZFS snapshots and file systems

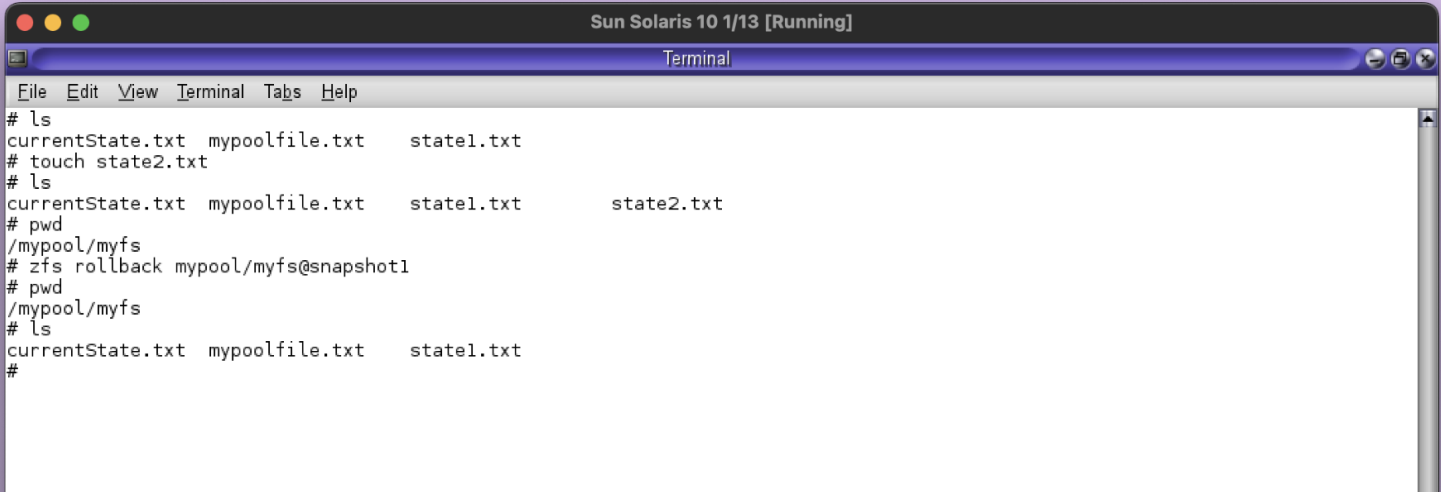


```
Sun Solaris 10 1/13 [Running]
Terminal
File Edit View Terminal Tabs Help
# pwd
/mypool/myfs
# ls
currentState.txt mypoolfile.txt state1.txt
# zfs snapshot mypool/myfs@snapshot1
# zfs list -t snapshot
invalid type 'snapshot'
For more info, run: zfs help list
# zfs list -t snapshot
NAME                USED  AVAIL  REFER  MOUNTPOINT
mypool/myfs@snapshot1 0      -    31.5K  -
# zfs clone mypool/myfs@snapshot1 mypool/myclone
# zfs list -t clone
invalid type 'clone'
For more info, run: zfs help list
# zfs list help
cannot open 'help': dataset does not exist
# zfs help list
usage:
  list [-rH][-d max] [-o property[,...]] [-t type[,...]] [-s property] ...
  [-S property] ... [filesystem|volume|snapshot] ...
# zfs list -t all
NAME                USED  AVAIL  REFER  MOUNTPOINT
mypool               164K  9.78G  33K    /mypool
mypool/myclone       1K    9.78G  31.5K  /mypool/myclone
mypool/myfs          31.5K  9.78G  31.5K  /mypool/myfs
mypool/myfs@snapshot1 0      -    31.5K  -
rpool               7.34G  23.9G  42.5K  /rpool
rpool/ROOT          4.21G  23.9G  31K    legacy
rpool/ROOT/s10x_u11wos_24a 4.21G  23.9G  4.21G  /
rpool/dump           1.00G  23.9G  1.00G  -
rpool/export         63K    23.9G  32K    /export
rpool/export/home    31K    23.9G  31K    /export/home
rpool/swap           2.13G  24.0G  2.00G  -
#
```

# \* Demo - Snapshots

1. Create a new file
2. Rollback to snapshot
3. New file is gone

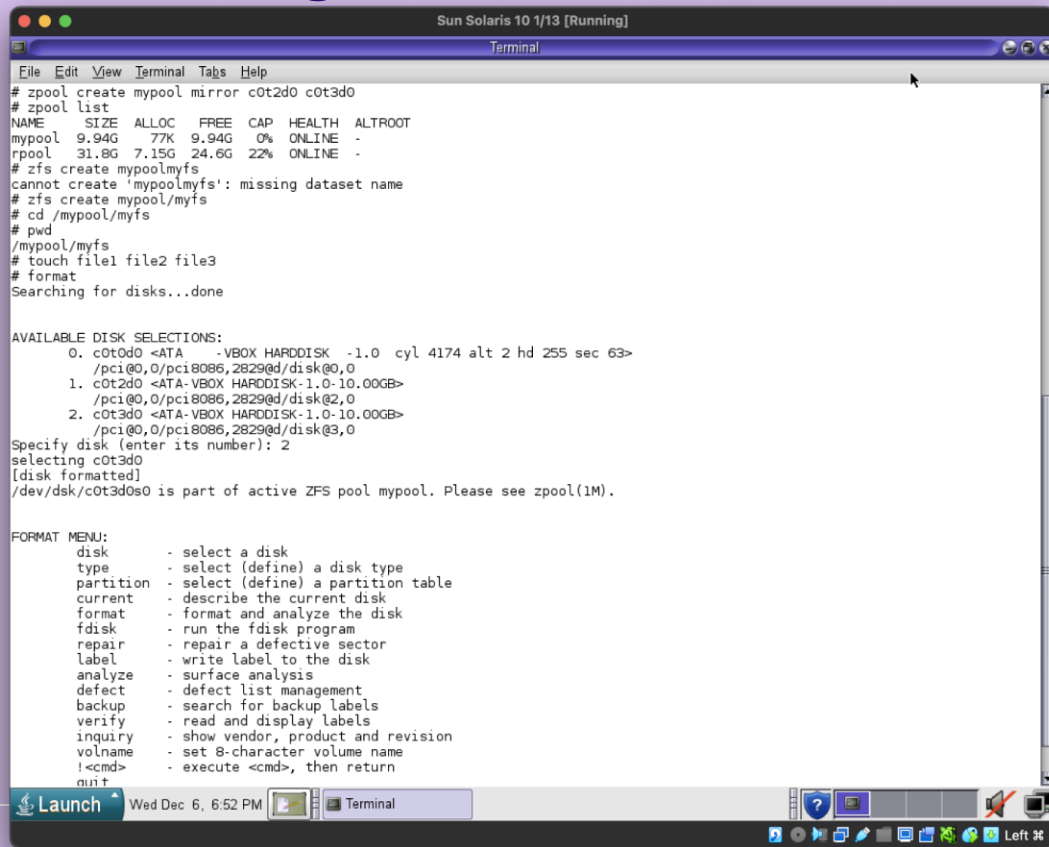
\* You can also send a receive snapshots between pools

A terminal window titled "Sun Solaris 10 1/13 [Running]" with a menu bar containing "File", "Edit", "View", "Terminal", "Tabs", and "Help". The terminal shows a sequence of commands and their outputs. First, "ls" shows three files: currentState.txt, mypoolfile.txt, and state1.txt. Then, "touch state2.txt" is executed. A second "ls" shows four files, including the newly created state2.txt. The user then runs "pwd" showing the current directory is /mypool/myfs. Next, the command "zfs rollback mypool/myfs@snapshot1" is entered. Another "pwd" confirms the directory is still /mypool/myfs. A final "ls" shows that only the three original files remain, as state2.txt has been removed after the rollback.

```
# ls
currentState.txt  mypoolfile.txt   state1.txt
# touch state2.txt
# ls
currentState.txt  mypoolfile.txt   state1.txt      state2.txt
# pwd
/mypool/myfs
# zfs rollback mypool/myfs@snapshot1
# pwd
/mypool/myfs
# ls
currentState.txt  mypoolfile.txt   state1.txt
#
```

# \* Demo – Scrubbing

1. Set up redundant ZFS pool
2. Create file system in pool
3. Add files



```
Sun Solaris 10 1/13 [Running]
Terminal
File Edit View Terminal Tabs Help

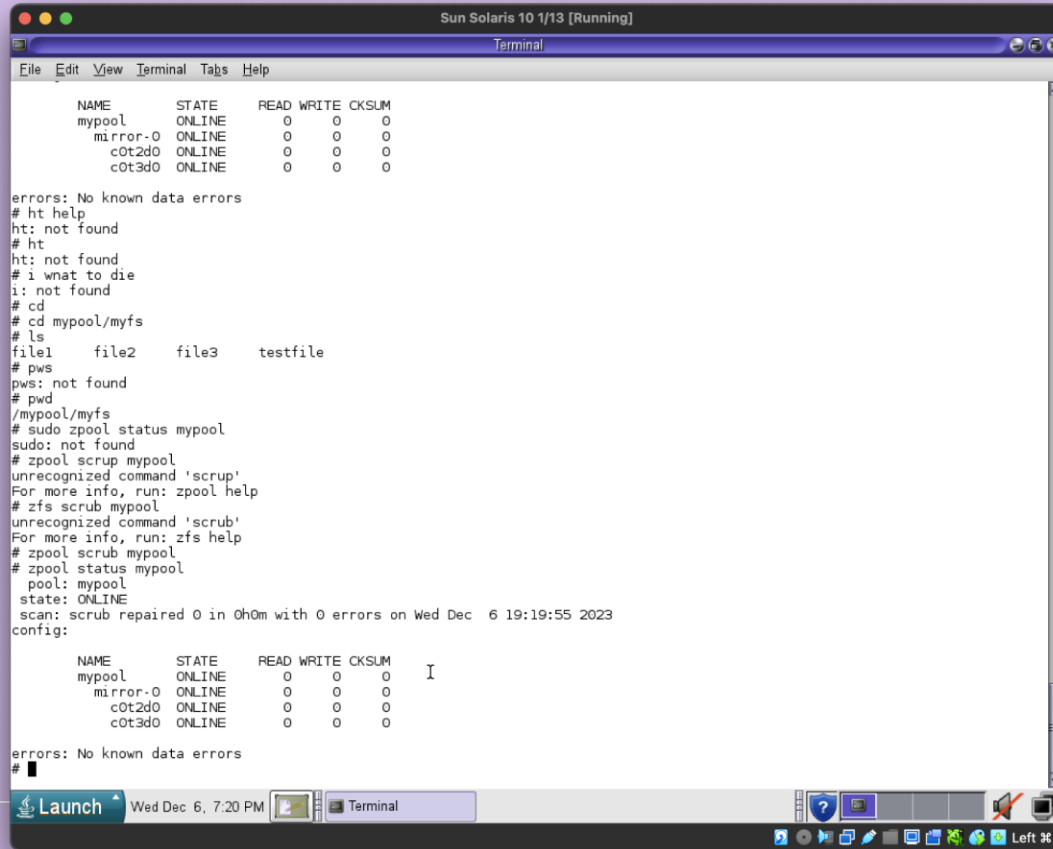
# zpool create mypool mirror c0t2d0 c0t3d0
# zpool list
NAME      SIZE  ALLOC   FREE   CAP  HEALTH  ALTROOT
mypool    9.94G   77K   9.94G    0%  ONLINE  -
rpool     31.8G   7.15G  24.6G   22%  ONLINE  -
# zfs create mypool/myfs
cannot create 'mypool/myfs': missing dataset name
# zfs create mypool/myfs
# cd /mypool/myfs
# pwd
/mypool/myfs
# touch file1 file2 file3
# format
Searching for disks...done

AVAILABLE DISK SELECTIONS:
  0. c0t0d0 <ATA -VBOX HARDISK -1.0 cyl 4174 alt 2 hd 255 sec 63>
    /pci@0,0/pci8086,2829@d/disk@0,0
  1. c0t2d0 <ATA-VBOX HARDISK-1.0-10.00GB>
    /pci@0,0/pci8086,2829@d/disk@2,0
  2. c0t3d0 <ATA-VBOX HARDISK-1.0-10.00GB>
    /pci@0,0/pci8086,2829@d/disk@3,0
Specify disk (enter its number): 2
selecting c0t3d0
[disk formatted]
/dev/dsk/c0t3d0s0 is part of active ZFS pool mypool. Please see zpool(1M).

FORMAT MENU:
disk          - select a disk
type          - select (define) a disk type
partition    - select (define) a partition table
current       - describe the current disk
format        - format and analyze the disk
fdisk         - run the fdisk program
repair        - repair a defective sector
label         - write label to the disk
analyze       - surface analysis
defect        - defect list management
backup        - search for backup labels
verify        - read and display labels
inquiry       - show vendor, product and revision
volname       - set 8-character volume name
!<cmd>        - execute <cmd>, then return
quit
```

# \* Demo – Scrubbing

1. Simulate disk corruption (overwrite small part of disk)
2. Perform ZFS scrub



The screenshot shows a terminal window titled "Sun Solaris 10 1/13 [Running]" with a "Terminal" tab. The terminal output displays the ZFS pool status for "mypool" and the results of a scrub operation.

```
NAME      STATE      READ WRITE CKSUM
mypool    ONLINE     0    0    0
mirror-0  ONLINE     0    0    0
c0t2d0    ONLINE     0    0    0
c0t3d0    ONLINE     0    0    0

errors: No known data errors
# ht help
ht: not found
# ht
ht: not found
# i what to die
i: not found
# cd
# cd mypool/myfs
# ls
file1    file2    file3    testfile
# pws
pws: not found
# pwd
/mypool/myfs
# sudo zpool status mypool
sudo: not found
# zpool scrub mypool
unrecognized command 'scrub'
For more info, run: zpool help
# zfs scrub mypool
unrecognized command 'scrub'
For more info, run: zfs help
# zpool scrub mypool
# zpool status mypool
pool: mypool
state: ONLINE
scan: scrub repaired 0 in 0h0m with 0 errors on Wed Dec  6 19:19:55 2023
config:

NAME      STATE      READ WRITE CKSUM
mypool    ONLINE     0    0    0
mirror-0  ONLINE     0    0    0
c0t2d0    ONLINE     0    0    0
c0t3d0    ONLINE     0    0    0

errors: No known data errors
#
```

The terminal window includes a menu bar with "File", "Edit", "View", "Terminal", "Tabs", and "Help". The bottom of the window shows a taskbar with a "Launch" button, the date and time "Wed Dec 6, 7:20 PM", and several system icons.



## Demo – Alternative Results

```
dd if=/dev/zero of=zfs-test/tank-file$i bs=1G count=1 &> /dev/null; done
```

```
sudo zpool scrub tank1; sudo zpool status -v tank1
pool: tank1
state: ONLINE
status: One or more devices has experienced an error resulting in data
corruption. Applications may be affected.
action: Restore the file in question if possible. Otherwise restore the
entire pool from backup.
see: http://zfsonlinux.org/msg/ZFS-8000-8A
scan: scrub repaired 0 in 0h0m with 1 errors on Sun Jan 11 20:16:30 2015
config:
```

NAME	STATE	READ	WRITE	CKSUM
tank1	ONLINE	0	0	1
/home/kenny/zfs-test/tank-file1	ONLINE	0	0	2

```
errors: Permanent errors have been detected in the following files:
```

```
tank1@snapshot2:/test-text-file
```

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# Works Cited

[https://docs.oracle.com/cd/E23824\\_01/html/821-1453/gexkw.html](https://docs.oracle.com/cd/E23824_01/html/821-1453/gexkw.html)

<https://serverfault.com/questions/658819/zfs-recover-or-repair-a-corrupted-file-in-a-snapshot-from-backup>

<https://techbreakthroughs.info/solaris-vs-linux/>

<https://techbreakthroughs.info/solaris-vs-linux/>

<https://docs.oracle.com/en/operating-systems/solaris.html>

<https://itsfoss.com/what-is-zfs/>

