Relax and Recover

# Linux Disaster Recovery best practices with rear

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# Who am I

- Independent Unix System Engineer since 1996
- Unix user since 1986
- Linux user since 1991
- Open Source contributor:
  - Make CD-ROM Recovery (mkCDrec)
  - Relax and Recover (rear)
  - SIM Installation and Logging (WBEMextras)
  - Adhoc Copy and Run (adhocr)
  - Config-to-HTML (cfg2html v6.x)

# What is your Disaster Recovery Plan?

- Business Continuity Planning
  - A business continuity plan specifies how a company plans to restore core business operations when disasters occur
- Disaster Recovery
  - Disaster recovery looks specifically at the technical aspects of how a company can get back into operation using backup facilities

# Disaster Recovery Concerns

- Uptime
  - Quick restores with minimal or no manual steps after the recovery
- Reliability
  - Avoid corrupted file systems and that system boots after recovery
- Cost
  - DR solutions need to be affordable
- Complexity
  - DR plans tend to be too complex.

# Disaster Recovery Strategies

- **Online**
- Backup independent of disk layout and sizes
- Restore requires some effort (can be scripted)
- Online DR solution is not a backup/restore tool as latest data must be restored from backup

- **Offline** (disk imaging)
- No open file issues
- Simple to restore to same hardware
- Restore on other similar HW is unreliable
- No “perfect” open source tool available for Linux

# GPL DR Solutions

- Mondorescue http://www.mondorescue.org/
  - Started in 2000
  - Stable and lots of contributors
  - Needs lots of pre-requisites
  - Proper documentation
- Relax and recover (rear) http://relax-and-recover.org/
  - Started in 2006
  - Evolving rapidly, less stable versions
  - Simple in use and quick; friendly developers

## Relax and Recover (rear) as DR solution

- Rear is a tool that implements a DR work-flow for Linux
- Basically meaning:
  - Modular framework written in Bash
  - Easy to extend to own needs
  - Easy to deploy (set up and forget)
  - Integration for various Linux technologies
  - Integration with various back-up solutions
  - Attempts to make recovery as easy as possible

# Relax and Recover – What is Rear?

- **http://relax-and-recover.org/**
- GPL Software – Developers in Germany and Belgium
- 100% Bash script – no GUI and no dependencies
- Utilize kernel, modules, binaries of host (kernel ≥ 2.6)
- Support any combination of SW/HW RAID, LVM
- Internal backup on CIFS, NFS, rsync ...
- Boot media on CD/DVD, USB storage and LAN (PXE)
- Bootable tapes
- Successor of **mkCDrec**

# Relax and Recover - Features

- Focus on disaster recovery and **not** backup
- Tight integration with common backup software – delegate file backup to backup infrastructure
- Simple *full* backup integrated
- Complements backup software:
  - Backup software: Data storage and retrieval
  - Rear: Recover system layout and make it work again
  - Rear utilizes the backup software to restore the backup data
- Use the best tool for the job

# Relax and Recover – Relaxing features

- Local GRUB integration (password protected)
- Serial console support (think: disaster)
- History-stuffing during recovery
- Network and SSH key integration
- Layout code guides you through recovery
  - Menu's and command-line in one session
  - Provides original storage info
- Beep, UID led and USB suspend integration
- Syslinux management
- Log-file on recovery media

# Decide on DR strategy

- Which backup mechanism to use?
  - Internal backup: GNU tar, rsync
  - External backup: bacula, Bareos, commercial backup solution
- Where will the backups reside?
  - NFS share, CIFS share, external USB disk, tape, local spare disk, DVD
  - Remote network location
- How shall we start the rescue image?
  - Via CDROM (ISO image), tape (OBDR), network (PXE), USB disk

## Disaster Recovery - Media

- Most important: External storage!
- Bootable media: CD/DVD, USB key, LAN, tape ...
- Media usually combination boot and backup media:
    - Bootable CD/DVD, USB key with backup data on it
    - LAN boot (PXE) with backup data via CIFS, NFS ...
    - Bootable tapes - HP OBDR (CD emulation)
- Separation between boot media and backup data
    - Boot the system from a (small) USB key, CD/DVD or LAN
    - Recover the system with backup software, tar, rsync ...

# Disaster Recovery – How It Works

- Store the disk layout
  - Partitioning, LVM and RAID configuration
  - File systems, file system labels ...
  - Boot loader (GRUB, GRUB2, LILO, UEFI)
- Store the files (tgz, rsync, through backup software ...)
- Create bootable rescue media with system configuration (and backup data)
- Can be done online
  - No business interruption
  - 100% compatible with original systems hard- and software

# Disaster Recovery – Rescue Media

- Create “rescue linux” from running system
- Optimally compatible “tool box”
- Clone the system environment
  - Linux kernel and modules
  - Device driver configuration
  - Network configuration
  - Basic system software and tools
- Operate entirely in RAM (initrd)

## Disaster Recovery – In Action

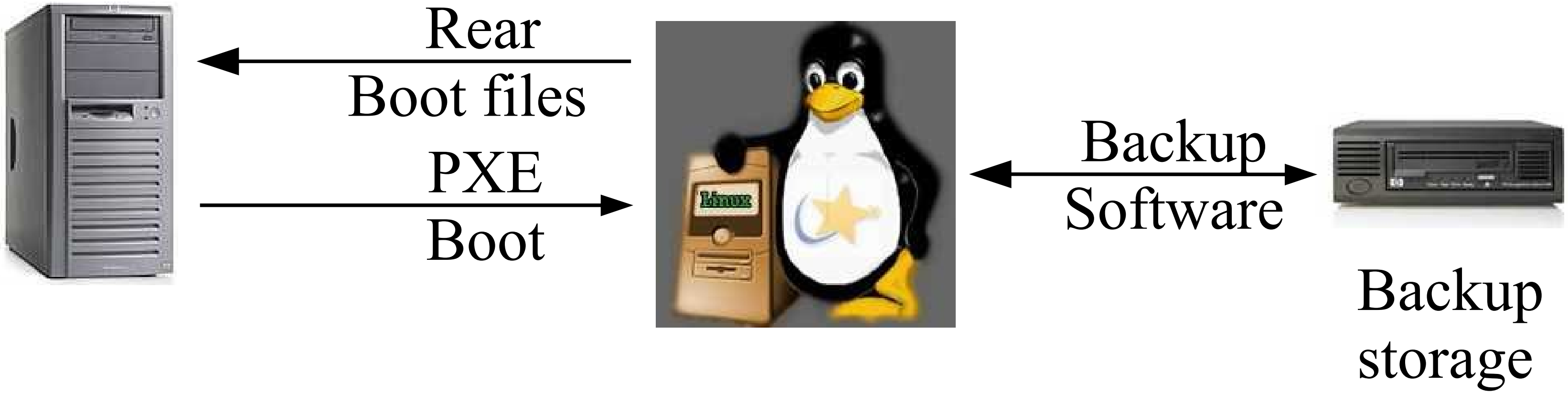
- Boot system from rescue media
- Restore disk layout
  - Create partitions, RAID configuration and LVM
  - Create file systems (mkfs, mkswap)
  - Configure file systems (labels, mount points)
- Restore the backup data
- Restore the boot loader
- Reboot
- Done!

# Relax and Recover – Backup Software

- Supported solutions include:
  - CommVault Galaxy
  - IBM Tivoli Storage Manager
  - Symantec NetBackup, HP Data Protector
  - EMC$^2$ Networker (Legato)
  - Bacula, Bareos
  - Duplicity (experimental)
  - Rsync and other “external” methods
  - GNU tar archive on NAS share – CIFS, NFS, NCP ...
- Very transparent integration
- Can be easily extended to support other vendors

## Relax and Recover – Network Integration

- Disaster recovery as part of network infrastructure
  - Backup software – file-level backup storage
  - Rear – system environment
  - Boot rescue media via PXE – no physical media required
  - Very scalable – automated installation of entire disaster recovery data center



Rear

Boot files

PXE

Boot

Backup

Software

Backup storage

## Getting started with Relax and Recover (rear)

- Download it from
  - Stable rear rpm's build from Github
    - http://download.opensuse.org/repositories/Archiving:/Backup:/Rear/
  - The rear-snapshot rpm's build from Github
    - http://download.opensuse.org/repositories/Archiving:/Backup:/Rear:/Snapshot/
  - The official source
    - https://github.com/rear/rear
  - The official repo's (Fedora, EPEL and SLES)
    - yum install rear
    - zypper install rear

# Installation of rear

- E.g. on Fedora 17

```
# yum install rear
Installing:
 rear                              noarch                  1.13.0-1.fc17                        fedora                 327 k
Installing for dependencies:
 at                                i686                    3.1.13-7.fc17                        fedora                  61 k
 bc                                i686                    1.06.95-6.fc17                       fedora                 106 k
 binutils                          i686                    2.22.52.0.1-5.fc17                   fedora                 3.6 M
 ed                                i686                    1.5-3.fc17                           fedora                  72 k
 ethtool                           i686                    2:3.2-2.fc17                         fedora                  93 k
 genisoimage                       i686                    1.1.11-10.fc17                       fedora                 338 k
 ….
Install  1 Package (+40 Dependent packages)
Total download size: 21 M
Installed size: 65 M
Is this ok [y/N]: y
```

- **We also need syslinux (and to boot on USB: extlinux)**

```
# yum install syslinux
```

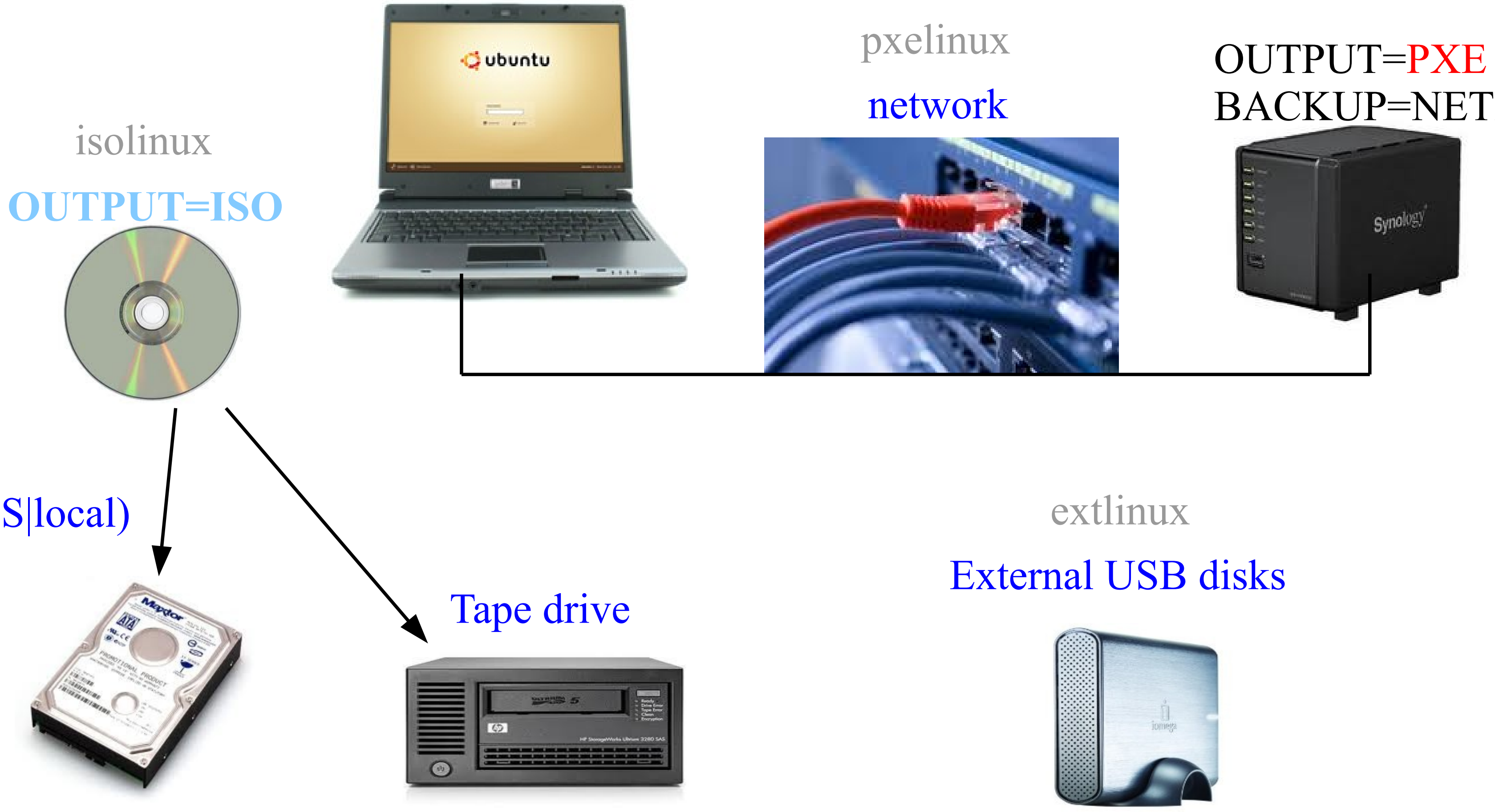
- **Install nfs-utils, cifs-utils, rsync if required**
- **Do not forget openssh(-clients)**

- **Internal BACKUP=**
  - **NETFS**: NFS, CIFS, USB, TAPE, ISO, FILE
    - BACKUP_PROG=tar, or rsync (not for TAPE, ISO)
  - **RSYNC**: rsync method
    - BACKUP_PROG=rsync (to remote location)
- **External BACKUP=**
  - REQUESTRESTORE, EXTERNAL
  - BACULA, BAREOS ("open source" backup software)
  - DP, NBU, TSM, NSR, GALAXY (commercial stuff)
  - RBME ("open source" rsync backup made easy)

# Relax and Recover - Output Flows

- OUTPUT defines the destination of the rescue image
- Valid OUTPUT types are:
  - ISO – creates a bootable ISO image
  - USB – creates a bootable USB disk/stick
  - PXE – creates a bootable PXE/TFTP image
  - OBDR – creates a bootable tape (ISO emulation)
  - RAMDISK – creates a bootable RAM image

# BACKUP type NETFS (internal backup solution)



isolinux

OUTPUT=ISO

pxelinux

network

OUTPUT=PXE
BACKUP=NETFS

(NFS|CIFS|local)
disks

Tape drive

extlinux

External USB disks

OUTPUT=ISO
BACKUP=NETFS

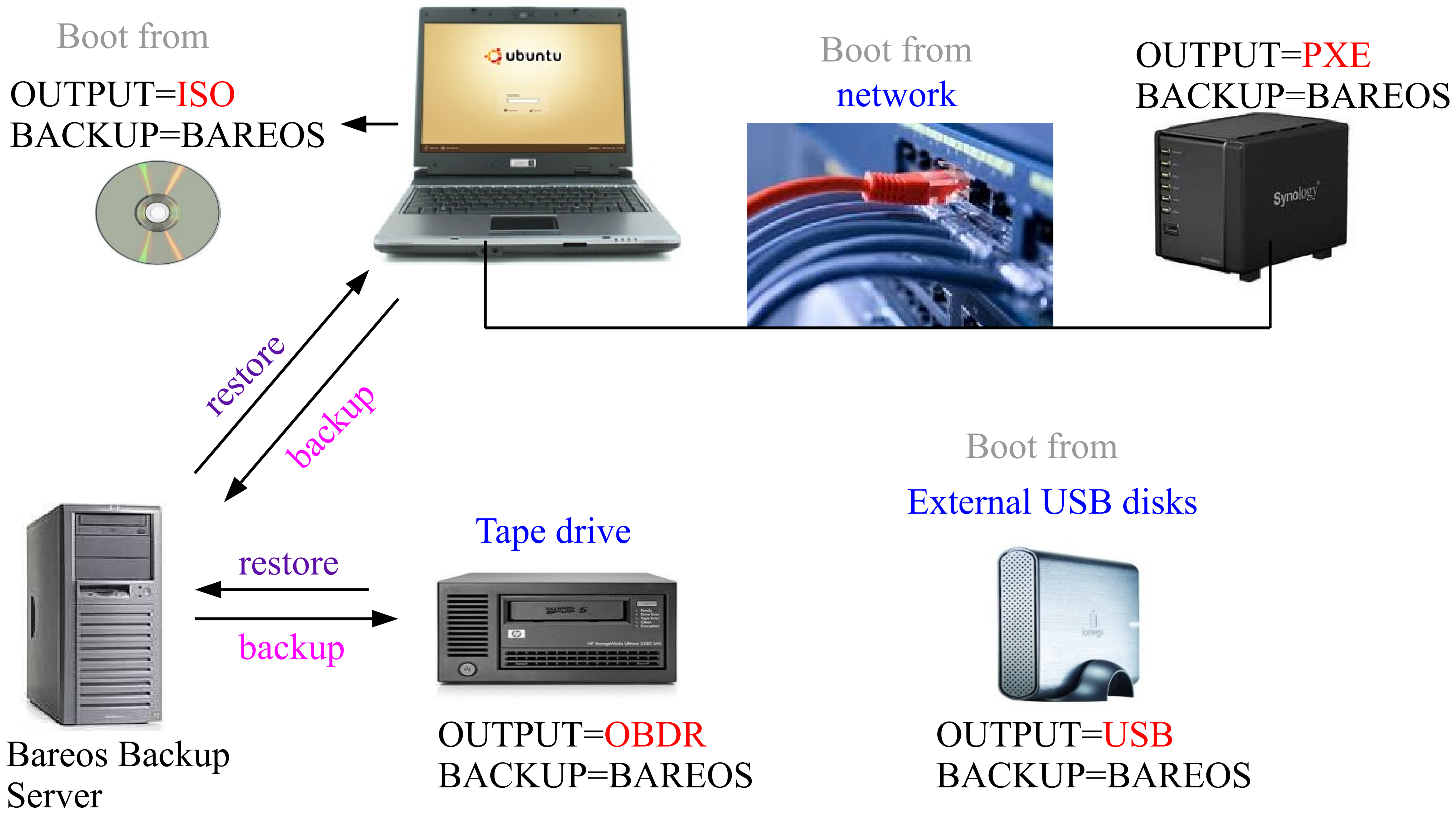
OUTPUT=OBDR
BACKUP=NETFS

OUTPUT=USB
BACKUP=NETFS

## Location BACKUP_URL

- **BACKUP=NETFS**
- **BACKUP_URL** can be
  - File type: BACKUP_URL=file:///directory/
  - NFS type: BACKUP_URL=nfs://nfs-server/directory/
  - CIFS type: BACKUP_URL=cifs://samba/directory/
  - USB type: BACKUP_URL=usb:///dev/sdc1/directory/
  - Tape type: BACKUP_URL=tape:///dev/nst0
  - ISO type: BACKUP_URL=iso:///directory/

# BACKUP type BAREOS (external backup solution)



Boot from

OUTPUT=ISO
BACKUP=BAREOS

Boot from
network

OUTPUT=PXE
BACKUP=BAREOS

restore

backup

Boot from

External USB disks

Tape drive

restore

backup

Bareos Backup
Server

OUTPUT=OBDR
BACKUP=BAREOS

OUTPUT=USB
BACKUP=BAREOS

# /etc/rear/local.conf

- Define your settings in /etc/rear/local.conf (or /etc/rear/site.conf)

-
  ```
  # grep -v -E '(^#|^$)' /etc/rear/local.conf
  OUTPUT=ISO
  ```
- Add:
  ```
  BACKUP=NETFS
  BACKUP_URL=nfs://server/path
  ```
- On NFS server backup => /path/$(hostname)/

# Rear dump

- View system configuration:

```
# rear dump

Relax-and-Recover 1.14-git201308130912 / 2013-08-13
Dumping out configuration and system information
This is a 'Linux-x86_64' system, compatible with 'Linux-i386'.
System definition:
                                    ARCH = Linux-i386
                                      OS = GNU/Linux
                        OS_MASTER_VENDOR = 
                       OS_MASTER_VERSION = 
                   OS_MASTER_VENDOR_ARCH = 
                OS_MASTER_VENDOR_VERSION = 
           OS_MASTER_VENDOR_VERSION_ARCH = 
                               OS_VENDOR = SUSE_LINUX
                               OS_VERSION = 11
```

# Rear help

- Usage: rear [-dDsSvV] [-r KERNEL] COMMAND [-- ARGS...]
- Available options:
  - **-d** debug mode; log debug messages
  - **-D** debugscript mode; log every function call
  - **-r KERNEL** kernel version to use; current: '2.6.42.3-2.fc15.i686.PAE'
  - **-s** simulation mode; show what scripts rear would include
  - **-S** step-by-step mode; acknowledge each script individually
  - **-v** verbose mode; show more output
  - **-V** version information

# Rear help

- Usage: rear [-dDsSvV] [-r KERNEL] COMMAND [-- ARGS...]
- List of commands:

| | |
|---|---|
| – checklayout | check if the disk layout has changed |
| – format | format and label media for use with rear |
| – mkbackup | create rescue media and backup system |
| – mkbackuponly | backup system without creating rescue media |
| – mkrescue | create rescue media only |
| – recover | recover the system; only valid during rescue |
| – savelayout | save the disk layout of the system |
| – shell | start a bash within rear; development tool |

- Gather system information
- Store the disk layout
  - Partitioning, LVM and RAID configuration
  - File systems, file system labels ...
  - Boot loader (GRUB, LILO, UEFI)
- Make a system backup (OS and user data)
- Create boot-able rescue media with system configuration (and optional with backup data)
- All steps are done “**online**”

# Rear mkrescue

- Will create an ISO image stored as
  - `/var/log/rear/rear-$(hostname).iso`
  - On NFS server as `/path/$(hostname)/rear-\$(hostname).iso`
- Inspect file `/var/lib/rear/layout/disklayout.conf`
- Try to boot from the ISO image into the RESCUE system
  - Use '`dmesg`' to check if devices were found

# Rear mkbackup

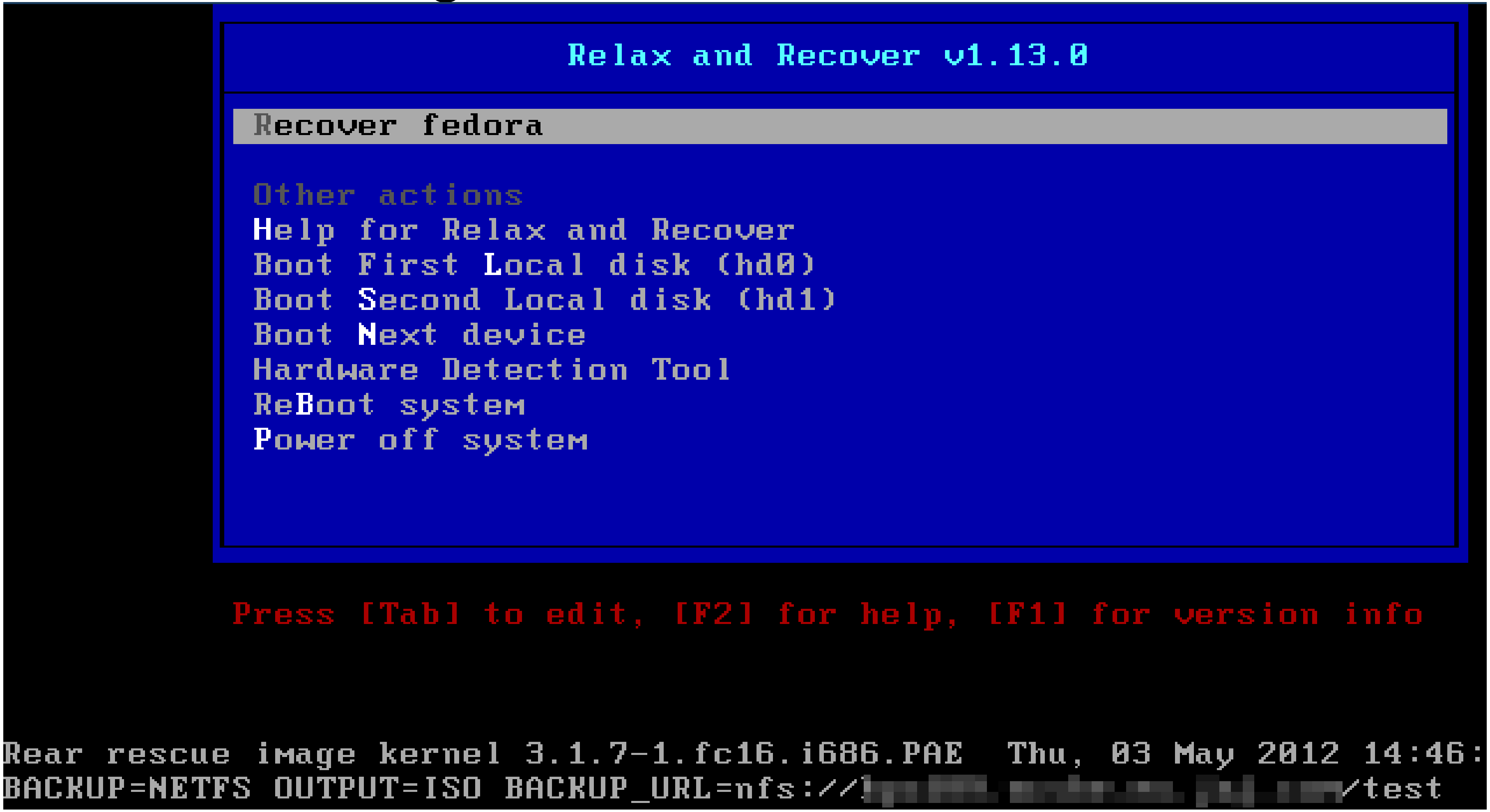
- Create rescue image with backup archive
- Do not forget to browse through the `/var/log/rear/rear-$(hostname).log` file for errors

## Recovery Process in detail

- Boot system from rescue media
- Restore disk layout
    - Create partitions, RAID configuration and LVM
    - Create file systems (mkfs, mkswap)
    - Configure file systems (labels, mount points)
- Restore the backup data
- Restore the boot loader
- Inspect & Reboot

# Recover with rear (1)

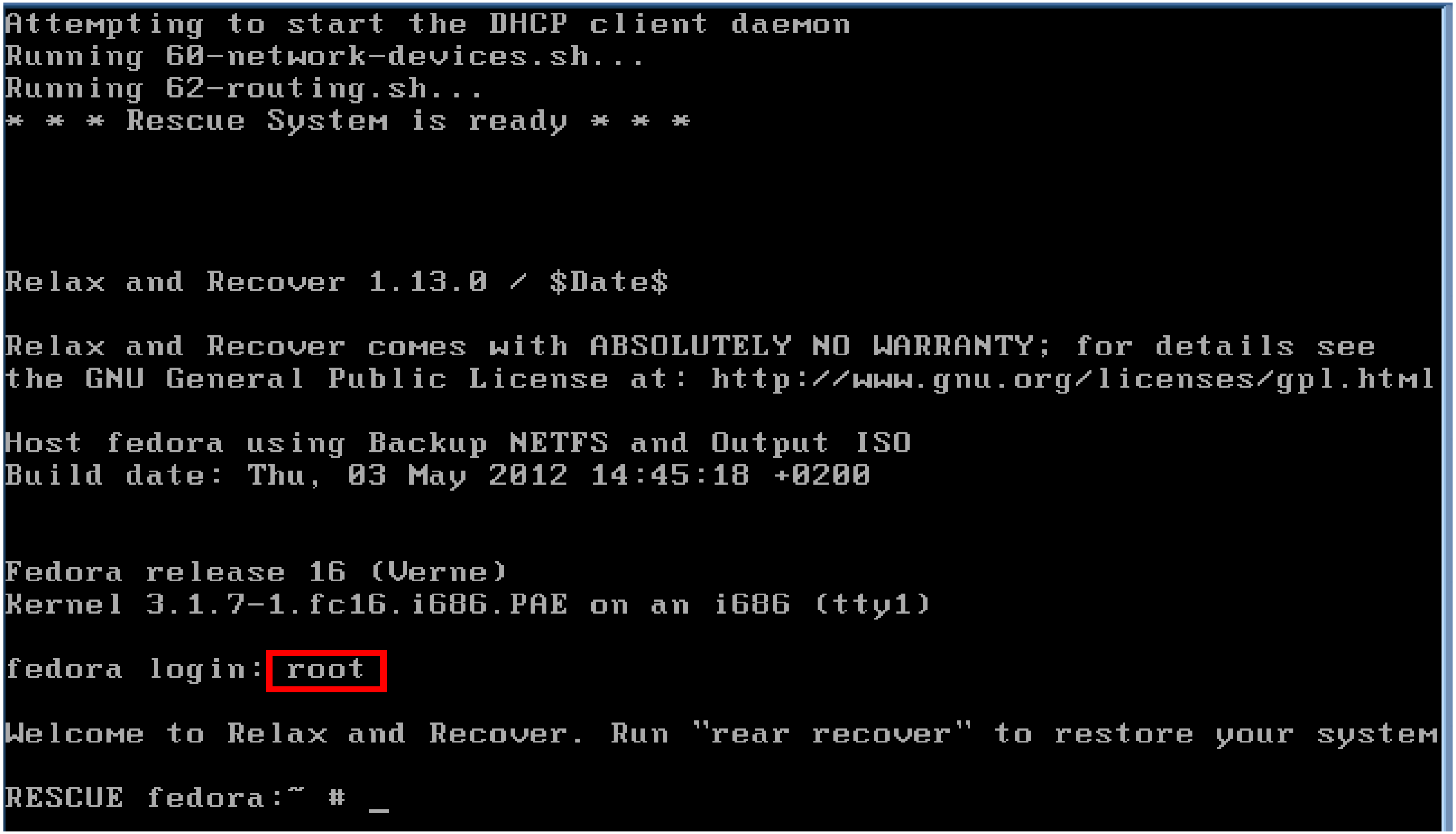
- Boot rescue image and select 'recover'



```
Relax and Recover v1.13.0

Recover fedora

Other actions
Help for Relax and Recover
Boot First Local disk (hd0)
Boot Second Local disk (hd1)
Boot Next device
Hardware Detection Tool
ReBoot system
Power off system

Press [Tab] to edit, [F2] for help, [F1] for version info

Rear rescue image kernel 3.1.7-1.fc16.i686.PAE  Thu, 03 May 2012 14:46:
BACKUP=NETFS OUTPUT=ISO BACKUP_URL=nfs://[redacted]/test
```

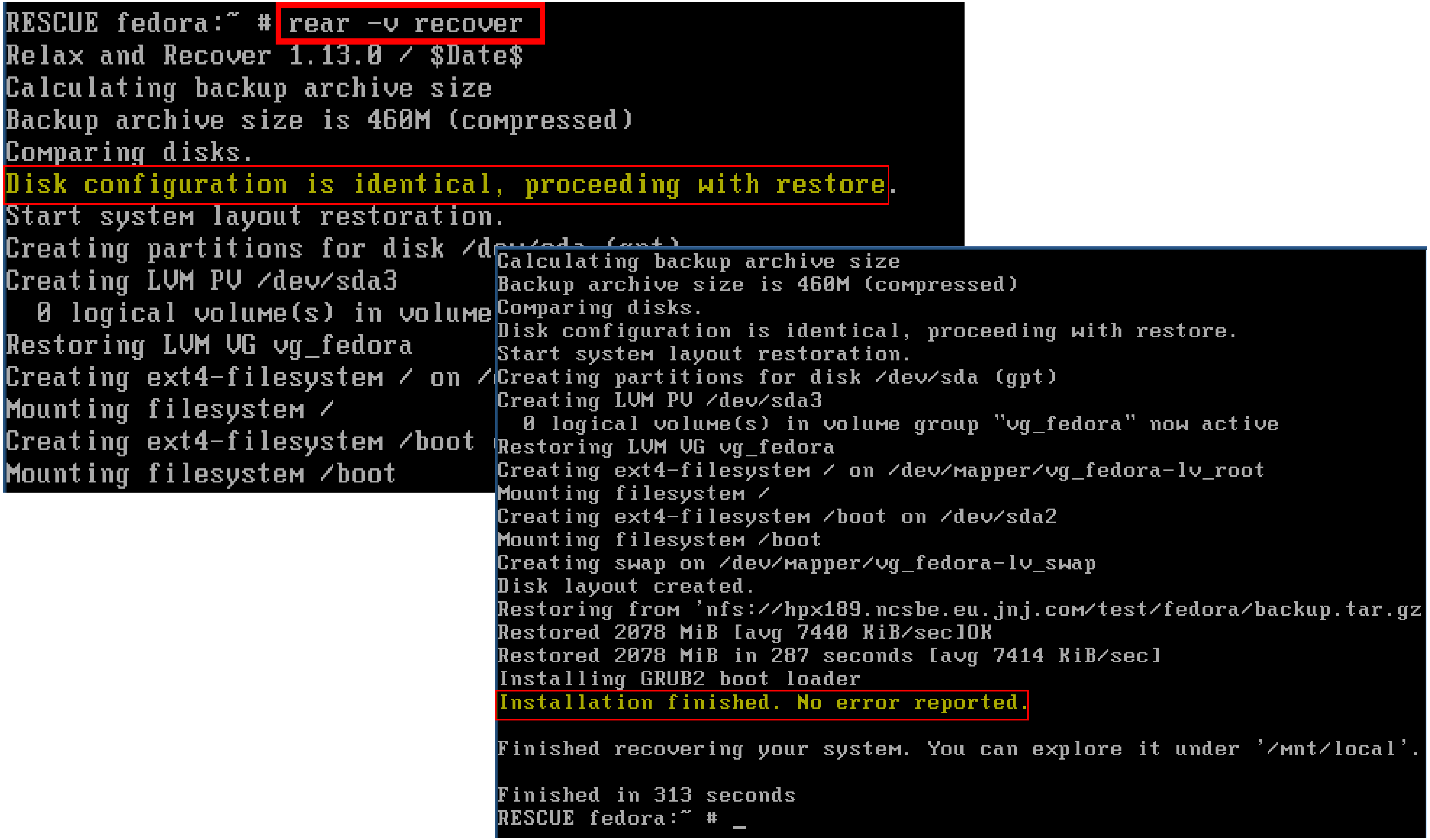
# Recover with rear (2)

- Wait until you see the login prompt



```
Attempting to start the DHCP client daemon
Running 60-network-devices.sh...
Running 62-routing.sh...
* * * Rescue System is ready * * *




Relax and Recover 1.13.0 / $Date$

Relax and Recover comes with ABSOLUTELY NO WARRANTY; for details see
the GNU General Public License at: http://www.gnu.org/licenses/gpl.html

Host fedora using Backup NETFS and Output ISO
Build date: Thu, 03 May 2012 14:45:18 +0200


Fedora release 16 (Verne)
Kernel 3.1.7-1.fc16.i686.PAE on an i686 (tty1)

fedora login: root

Welcome to Relax and Recover. Run "rear recover" to restore your system

RESCUE fedora:~ # _
```

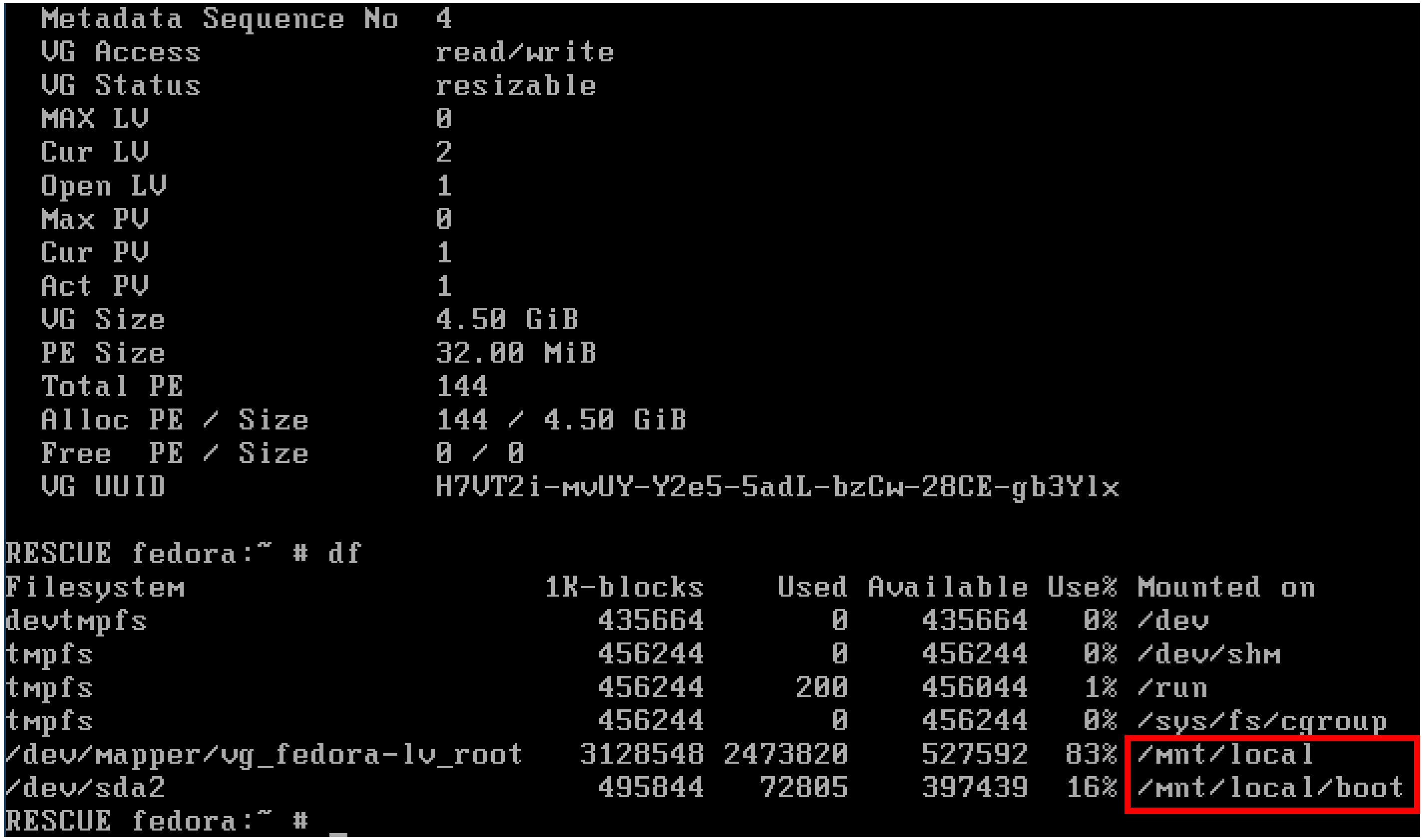
# Recover with rear (3)



```
RESCUE fedora:~ # rear -v recover
Relax and Recover 1.13.0 / $Date$
Calculating backup archive size
Backup archive size is 460M (compressed)
Comparing disks.
Disk configuration is identical, proceeding with restore.
Start system layout restoration.
Creating partitions for disk /d
Creating LVM PV /dev/sda3
  0 logical volume(s) in volume
Restoring LVM VG vg_fedora
Creating ext4-filesystem / on /
Mounting filesystem /
Creating ext4-filesystem /boot
Mounting filesystem /boot
```

```
Calculating backup archive size
Backup archive size is 460M (compressed)
Comparing disks.
Disk configuration is identical, proceeding with restore.
Start system layout restoration.
Creating partitions for disk /dev/sda (gpt)
Creating LVM PV /dev/sda3
  0 logical volume(s) in volume group "vg_fedora" now active
Restoring LVM VG vg_fedora
Creating ext4-filesystem / on /dev/mapper/vg_fedora-lv_root
Mounting filesystem /
Creating ext4-filesystem /boot on /dev/sda2
Mounting filesystem /boot
Creating swap on /dev/mapper/vg_fedora-lv_swap
Disk layout created.
Restoring from 'nfs://hpx189.ncsbe.eu.jnj.com/test/fedora/backup.tar.gz
Restored 2078 MiB [avg 7440 KiB/sec]OK
Restored 2078 MiB in 287 seconds [avg 7414 KiB/sec]
Installing GRUB2 boot loader
Installation finished. No error reported.

Finished recovering your system. You can explore it under '/mnt/local'.

Finished in 313 seconds
RESCUE fedora:~ # _
```

## Recover with rear (4)



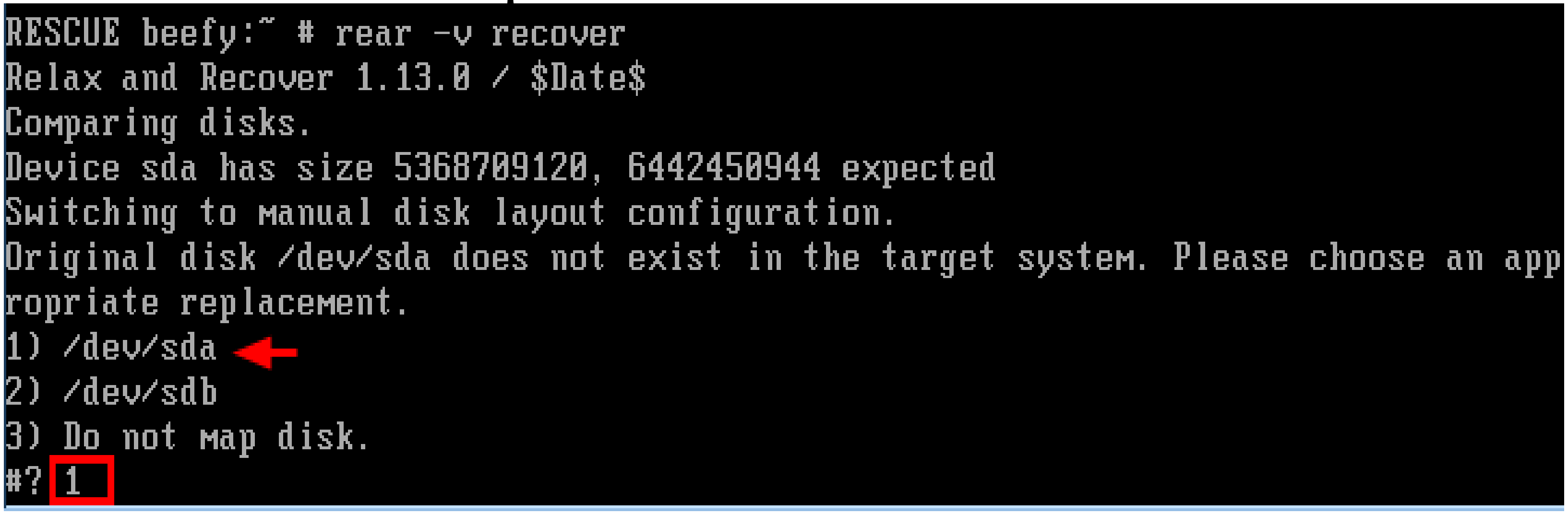
```
  Metadata Sequence No  4
  VG Access             read/write
  VG Status             resizable
  MAX LV                0
  Cur LV                2
  Open LV               1
  Max PV                0
  Cur PV                1
  Act PV                1
  VG Size               4.50 GiB
  PE Size               32.00 MiB
  Total PE              144
  Alloc PE / Size       144 / 4.50 GiB
  Free  PE / Size       0 / 0
  VG UUID               H7VT2i-mvUY-Y2e5-5adL-bzCw-28CE-gb3Ylx

RESCUE fedora:~ # df
Filesystem                    1K-blocks    Used Available Use% Mounted on
devtmpfs                         435664       0    435664   0% /dev
tmpfs                            456244       0    456244   0% /dev/shm
tmpfs                            456244     200    456044   1% /run
tmpfs                            456244       0    456244   0% /sys/fs/cgroup
/dev/mapper/vg_fedora-lv_root   3128548 2473820    527592  83% /mnt/local
/dev/sda2                        495844   72805    397439  16% /mnt/local/boot
RESCUE fedora:~ #
```

Ready? **Reboot (shutdown -r 0)**

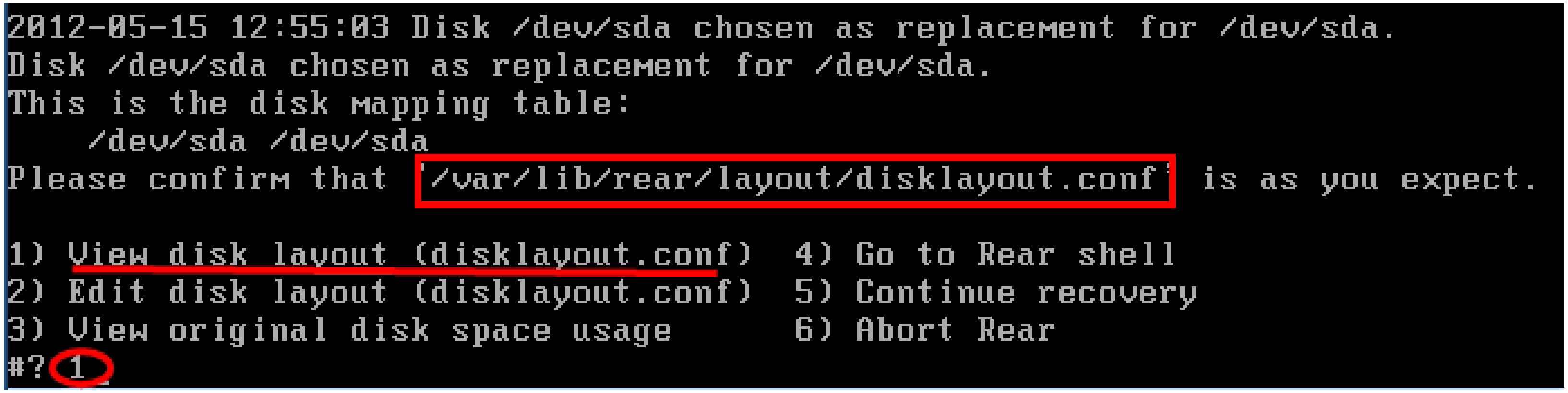
- That's it – wait a while for the selinux relabeling
- Verify the restored system

# Cloning with rear (1)

- Start the recover process: `rear -v recover`

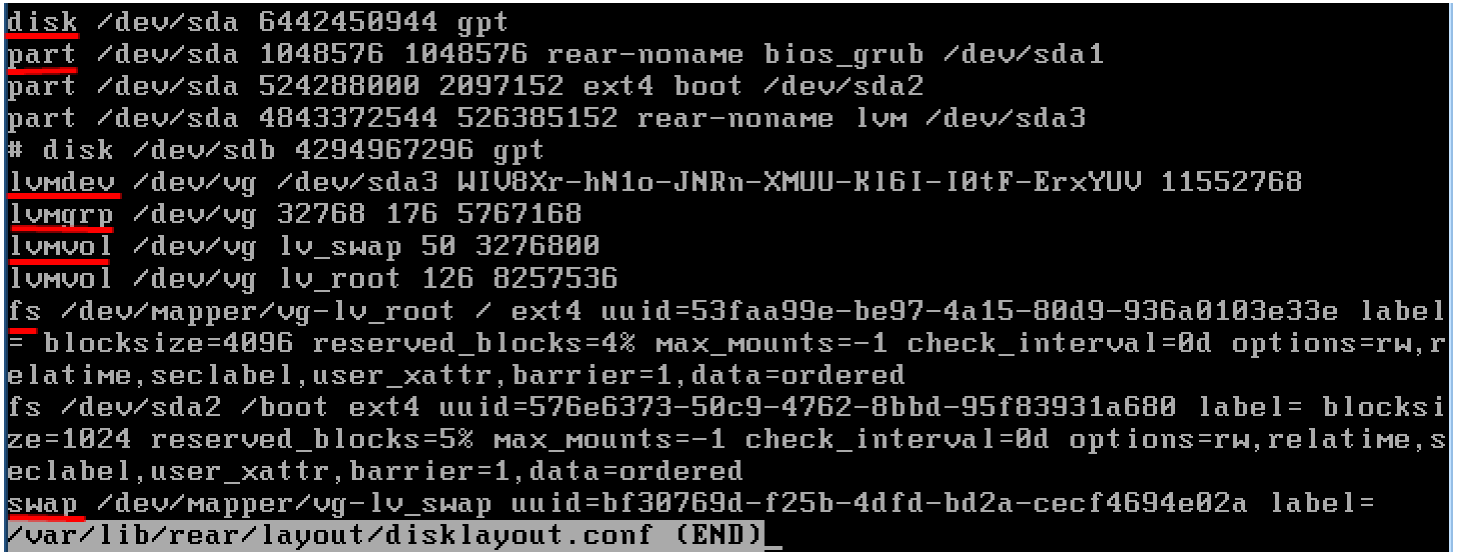


```
RESCUE beefy:~ # rear -v recover
Relax and Recover 1.13.0 / $Date$
Comparing disks.
Device sda has size 5368709120, 6442450944 expected
Switching to manual disk layout configuration.
Original disk /dev/sda does not exist in the target system. Please choose an app
ropriate replacement.
1) /dev/sda
2) /dev/sdb
3) Do not map disk.
#? 1
```

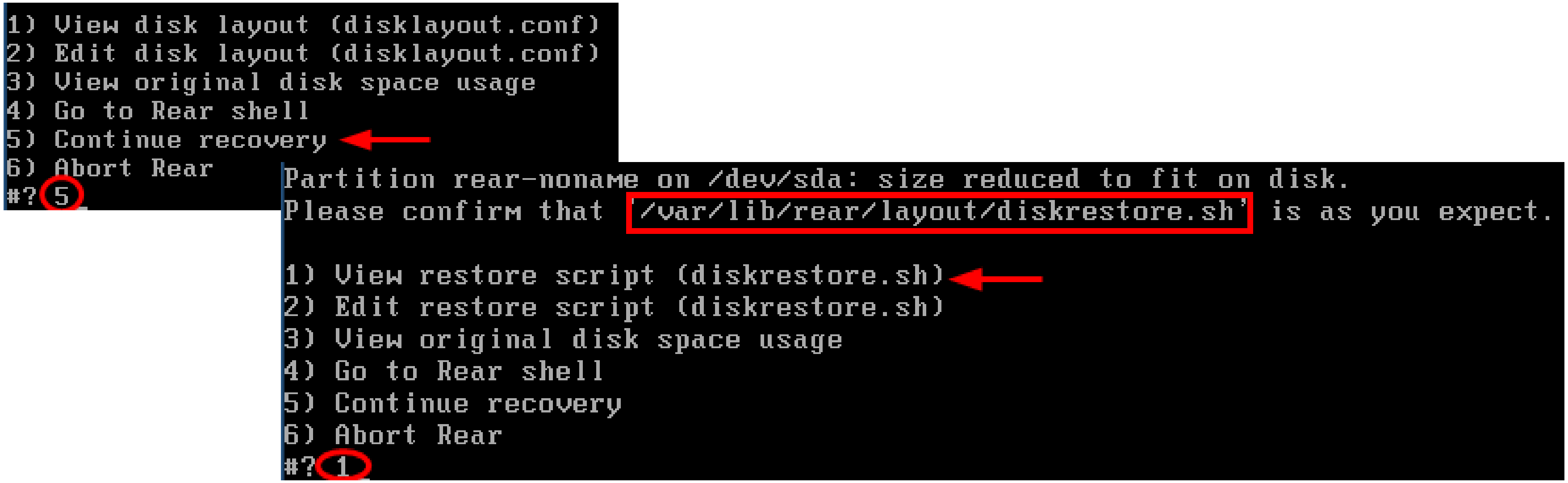


```
2012-05-15 12:55:03 Disk /dev/sda chosen as replacement for /dev/sda.
Disk /dev/sda chosen as replacement for /dev/sda.
This is the disk mapping table:
    /dev/sda /dev/sda
Please confirm that '/var/lib/rear/layout/disklayout.conf' is as you expect.

1) View disk layout (disklayout.conf)  4) Go to Rear shell
2) Edit disk layout (disklayout.conf)  5) Continue recovery
3) View original disk space usage      6) Abort Rear
#? 1
```

# Cloning with rear (2)



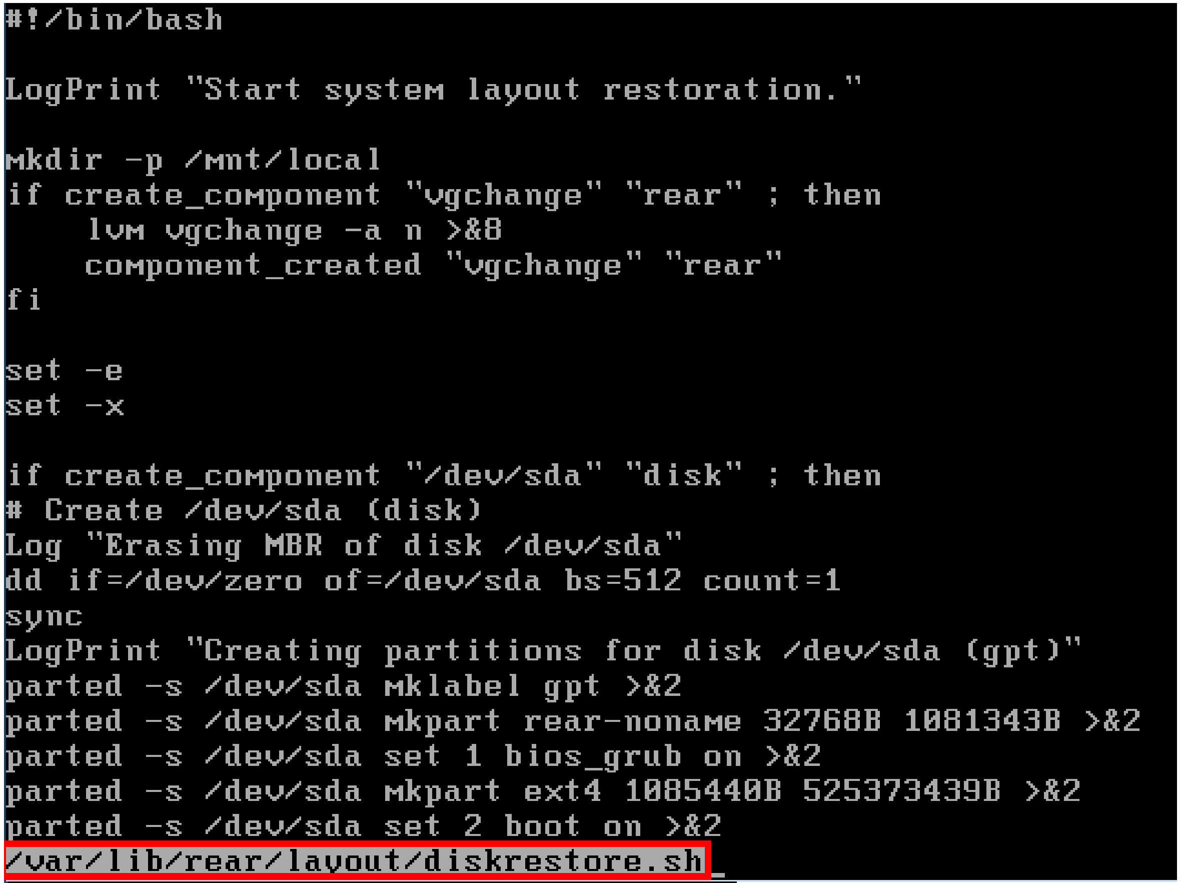
```
disk /dev/sda 6442450944 gpt
part /dev/sda 1048576 1048576 rear-noname bios_grub /dev/sda1
part /dev/sda 524288000 2097152 ext4 boot /dev/sda2
part /dev/sda 4843372544 526385152 rear-noname lvm /dev/sda3
# disk /dev/sdb 4294967296 gpt
lvmdev /dev/vg /dev/sda3 WIV8Xr-hN1o-JNRn-XMUU-K16I-I0tF-ErxYUV 11552768
lvmgrp /dev/vg 32768 176 5767168
lvmvol /dev/vg lv_swap 50 3276800
lvmvol /dev/vg lv_root 126 8257536
fs /dev/mapper/vg-lv_root / ext4 uuid=53faa99e-be97-4a15-80d9-936a0103e33e label
= blocksize=4096 reserved_blocks=4% max_mounts=-1 check_interval=0d options=rw,r
elatime,seclabel,user_xattr,barrier=1,data=ordered
fs /dev/sda2 /boot ext4 uuid=576e6373-50c9-4762-8bbd-95f83931a680 label= blocksi
ze=1024 reserved_blocks=5% max_mounts=-1 check_interval=0d options=rw,relatime,s
eclabel,user_xattr,barrier=1,data=ordered
swap /dev/mapper/vg-lv_swap uuid=bf30769d-f25b-4dfd-bd2a-cecf4694e02a label=
/var/lib/rear/layout/disklayout.conf (END)_
```



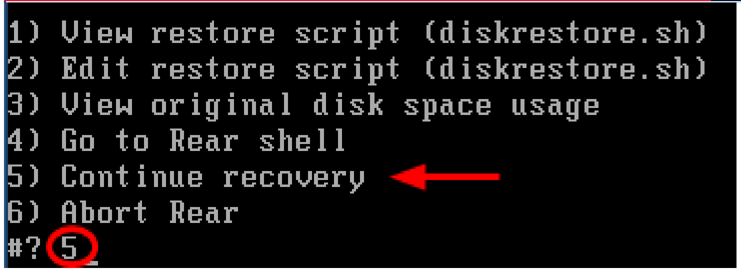
```
1) View disk layout (disklayout.conf)
2) Edit disk layout (disklayout.conf)
3) View original disk space usage
4) Go to Rear shell
5) Continue recovery
6) Abort Rear
#? 5
```

```
Partition rear-noname on /dev/sda: size reduced to fit on disk.
Please confirm that '/var/lib/rear/layout/diskrestore.sh' is as you expect.

1) View restore script (diskrestore.sh)
2) Edit restore script (diskrestore.sh)
3) View original disk space usage
4) Go to Rear shell
5) Continue recovery
6) Abort Rear
#? 1
```

# Cloning with rear (3)

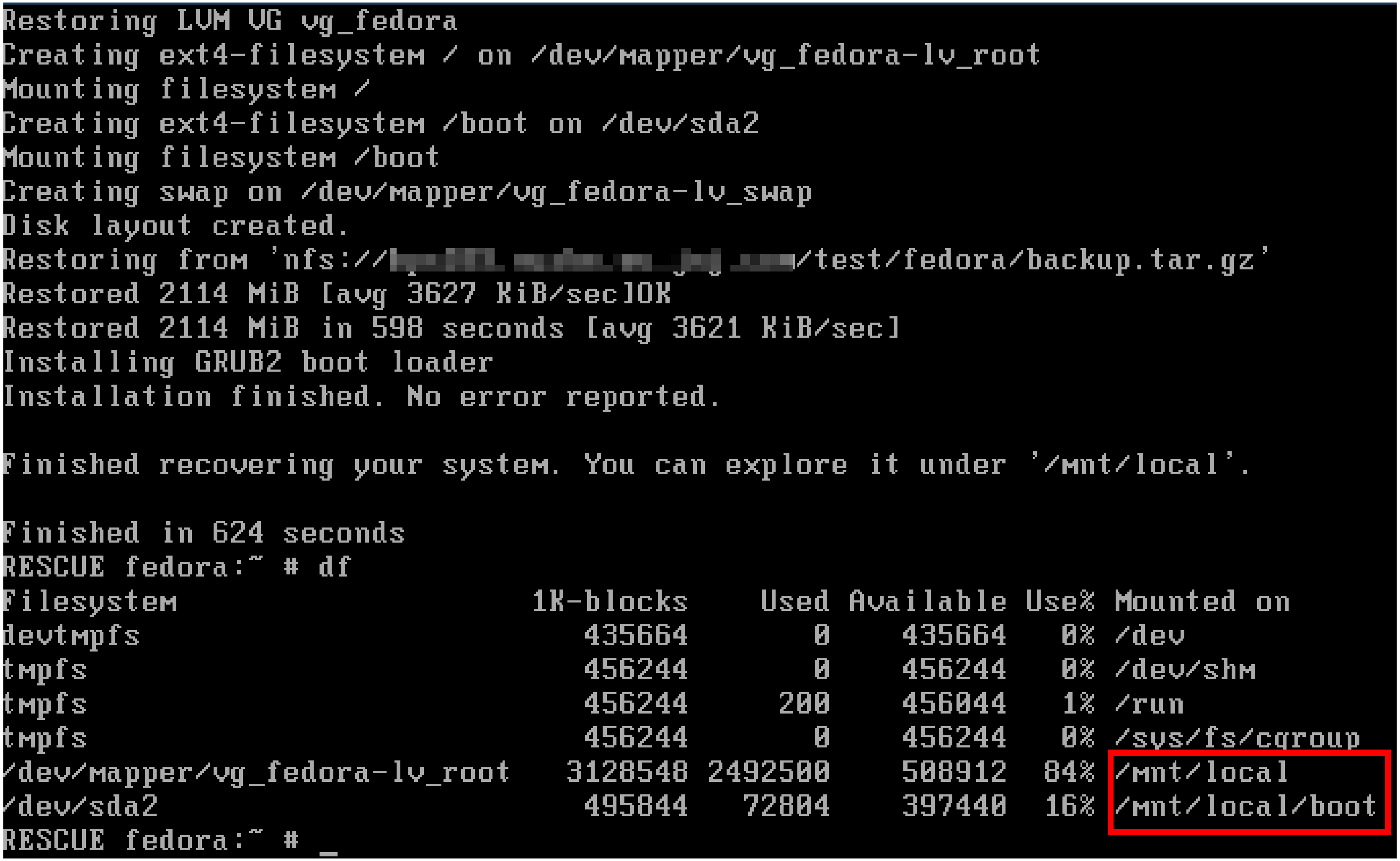


```
#!/bin/bash

LogPrint "Start system layout restoration."

mkdir -p /mnt/local
if create_component "vgchange" "rear" ; then
    lvm vgchange -a n >&8
    component_created "vgchange" "rear"
fi

set -e
set -x

if create_component "/dev/sda" "disk" ; then
# Create /dev/sda (disk)
Log "Erasing MBR of disk /dev/sda"
dd if=/dev/zero of=/dev/sda bs=512 count=1
sync
LogPrint "Creating partitions for disk /dev/sda (gpt)"
parted -s /dev/sda mklabel gpt >&2
parted -s /dev/sda mkpart rear-noname 32768B 1081343B >&2
parted -s /dev/sda set 1 bios_grub on >&2
parted -s /dev/sda mkpart ext4 1085440B 525373439B >&2
parted -s /dev/sda set 2 boot on >&2
/var/lib/rear/layout/diskrestore.sh
```



```
1) View restore script (diskrestore.sh)
2) Edit restore script (diskrestore.sh)
3) View original disk space usage
4) Go to Rear shell
5) Continue recovery
6) Abort Rear
#? 5
```

# Cloning with rear (5)



```
Restoring LVM VG vg_fedora
Creating ext4-filesystem / on /dev/mapper/vg_fedora-lv_root
Mounting filesystem /
Creating ext4-filesystem /boot on /dev/sda2
Mounting filesystem /boot
Creating swap on /dev/mapper/vg_fedora-lv_swap
Disk layout created.
Restoring from 'nfs://[redacted]/test/fedora/backup.tar.gz'
Restored 2114 MiB [avg 3627 KiB/sec]OK
Restored 2114 MiB in 598 seconds [avg 3621 KiB/sec]
Installing GRUB2 boot loader
Installation finished. No error reported.

Finished recovering your system. You can explore it under '/mnt/local'.

Finished in 624 seconds
RESCUE fedora:~ # df
Filesystem                   1K-blocks    Used Available Use% Mounted on
devtmpfs                        435664       0    435664   0% /dev
tmpfs                           456244       0    456244   0% /dev/shm
tmpfs                           456244     200    456044   1% /run
tmpfs                           456244       0    456244   0% /sys/fs/cgroup
/dev/mapper/vg_fedora-lv_root  3128548 2492500    508912  84% /mnt/local
/dev/sda2                       495844   72804    397440  16% /mnt/local/boot
RESCUE fedora:~ # _
```

# Get your hands dirty?

- We hope you want to dig deeper into rear!
- Getting started:
  - Use: `rear -s mkbackup`
    to see the flow of the scripts it will execute
  - Depends on BACKUP method, architecture and OS version/brand
  - Be careful: `rear -s recover`
    follows a different flow (seems logically, but you must understand the difference)

## Where to put a script?

- **mkbackup** method: /usr/share/rear/...
  - conf/ - configuration files (/etc/rear/*.conf read last)
  - prep/ - preparation work; checking the environment
  - layout/save/ - save the disk layout /var/lib/rear/layout
  - rescue/ - modules, network, storage,...
  - build/ - populate the initial ramdisk for our rescue image
  - pack/ - create the initrd and copy kernel
  - output/ - create the ISO image and copy to OUTPUT_URL
  - backup/ - make the backup archive to BACKUP_URL

## Where to put a script? (2)

- **recover** method: /usr/share/rear/...
  - conf/ - read the configuration file + /etc/rear/*.conf
  - setup/ - user defined scripts to run before recover
  - verify/ - to check if a recover is possible at all
  - layout/prepare – recreate the disk layout
  - restore/ - restore the archive from BACKUP_URL
  - finalize/ - do some dirty tricks for disks, grub,...
  - wrapup/ - copy the recover log to /mnt/local/root/

## Relax and Recover (rear)

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# Contacts

**Web-site: http://relax-and-recover.org/**
**GitHub: https://github.com/rear/rear**
**Mailing list: rear-users@lists.sourceforge.net**

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