**Backup procedure for Center for Relativity UNIX workstations**
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# 1 System Backups

Backups form a very important aspect of system administration. In the event of system failure or an accidental deletion of important files, backup turn out to be immensely useful. As a rule we carry out daily and weekly backups which go on at about midnight every weekday night.
The following subsections deal with how to create and use backups. The last subsection discusses what commands are used the the scripts used and some of the terms involved.

## 1.1 Making Backups

Backups are made for the Relativity network using the sysback shell script in /usr/local/adm/sysback/ on helmholtz. Cron on helmholtz runs this script every night at 11:45PM excluding Saturday night. It backs up all of our systems with filesystems on them provided the correct tape is present in the tape drive on helmholtz. The script detects which level of backup to carry out from the date and then checks a header on the backup tape to see if it is at the correct level. If the tape is not at the correct level the backup is aborted. That way, a previous days backup is not overwritten if left inside the tape drive. Thus as long as the operator regularly puts in the correct tape the backups are carried out smoothly.

There are two sets of daily backup tapes (ten in all) that are used daily monday through friday. This way two weeks of daily backups are stored at any given time. There are a set of seven weekly backup tapes. These tapes are used every week on sunday. As far as full system backups go, there are a full years set of them. The approach is to have level 0 (full) backups every six weeks or so. This backs up all files on the filesystems. Every sunday a weekly backup incrementally backs up at level 2 [1] all files that have changed or been created since the last level 0 backup. Subsequent daily backups will back up daily changes of files.

[1] In general level n backups will backup files that have changed or been created since the last level m backup. Where $m < n$.

The sysback script is discussed in further detail later. The current system for backing up is listed in the table below.

| | | |
|---|---|---|
| Monday | Level 3 | Daily |
| Tuesday | Level 5 | Daily |
| Wednesday | Level 4 | Daily |
| Thursday | Level 6 | Daily |
| Friday | Level 5 | Daily |
| Saturday | No Backup | |
| Sunday | Level 2 | Weekly |

## 1.2 Restoring files from backups

If a file needs to be restored, follow the following procedure.

1 Choice of tapes
If the user knows the last time he/she accessed the file then according to that date choose the appropriate tape. If it was the day before, then take last nights backup and put the tape in the tape drive. If the user last accessed the file over a week ago then the level 2(Weekly) backup should contain the file. So use the last weekly backup tape in that case. If you have a system catastrophe then go to the last level 0 backup for that system and restore files. Then go to the last weekly level 2 backup and restore on top of that. Then work incrementally on the daily backups to get to the latest set of changes.

2 How to move around on the tapes.
Each dump image on the tape is preceded by a short header which contains the system name, the filesystem name and the date on which the backup was carried out. Thus every two images on the tape is a header. To view such a header use the dd command as follows on helmholtz [2].
`dd conv=sync if=/dev/nrst17`
In the above command. `nrst` is a non-rewind tape device. This means that at the end of the command that the tape is not rewound. This is what we want for storing multiple images on one tape. We can store up to 5GB on one tape. Please refer to documentation on the exabyte tape drive for further information on the drive.

[2] You can also use the dd command from remote machines. See the man pages on dd

Having viewed the header you might find that the backup image contained is not the one you want. Then you would have to skip on image to get to the next header. To do this you use the `mt` command. To skip one image type:
`mt -f /dev/nrst17 fsf 1`
See the man pages on `mt` for all the options. This command gets us to the begining of the third image on the tape which is a header. Now display the header again using the first command(dd) and repeat the process until the filesystem you want appears in the header. The other approach, if you know approximately where the backup is on the tape is to fast-forward several images at a time. For example if I know that /usr on einstein was the 5th filesystem to be backed up then I would type:
`mt -f /dev/nrst17 fsf 8`
That is I move up 4 filesystem meaning 4 headers and 4 backup dumps. This gets me to the begining of the ninth image which is the fifth header. Once again use `dd` to view the header.

To**restore** files from a filesystem use the `restore` command [3].
`restore -ivf /dev/nrst17`
This invokes the interactive version of the `restore` command which allows one to list files stored on the particular tape image. Using the set of commands specified by the `restore` command one can select a set of files or directories to extract from tape. **NOTE** that there is a level of incompatibility between SGI `restore` and SUN `restore`. As will be explained in the next section each remote system uses the `rdump` command to backup filesystems directly to the tape drive on helmholtz. To restore from a SGI dump **do not use the SUN restore to restore the file! Use restore on the SGI to remotely restore the file from the SUN tapedrive.** There is to a level of incompatibility between the two as of `IRIX 5.2` which causes `ls -l` to list the contents of symbolic links. A further point to note is that SGIs have two different restore commands. One restores `bru` backups and the other restores `dump` or `rdump` backups. The current script uses the latter set of commands for backups. To restore remotely for our example of restoring files for einstein:/usr from helmholtz:/dev/nrst17 we use the following command:
`restore -ivf root@helmholtz:/dev/nrst17`
Once you have selected the files you want type extract and restore will ask

[3] See the man pages

you to enter the tape # number, just enter 1 and restore will restore files relative to the current directory you are in.

Please carefully read the man pages for `restore`, `dd` and `mt` for details on the options and commands used.

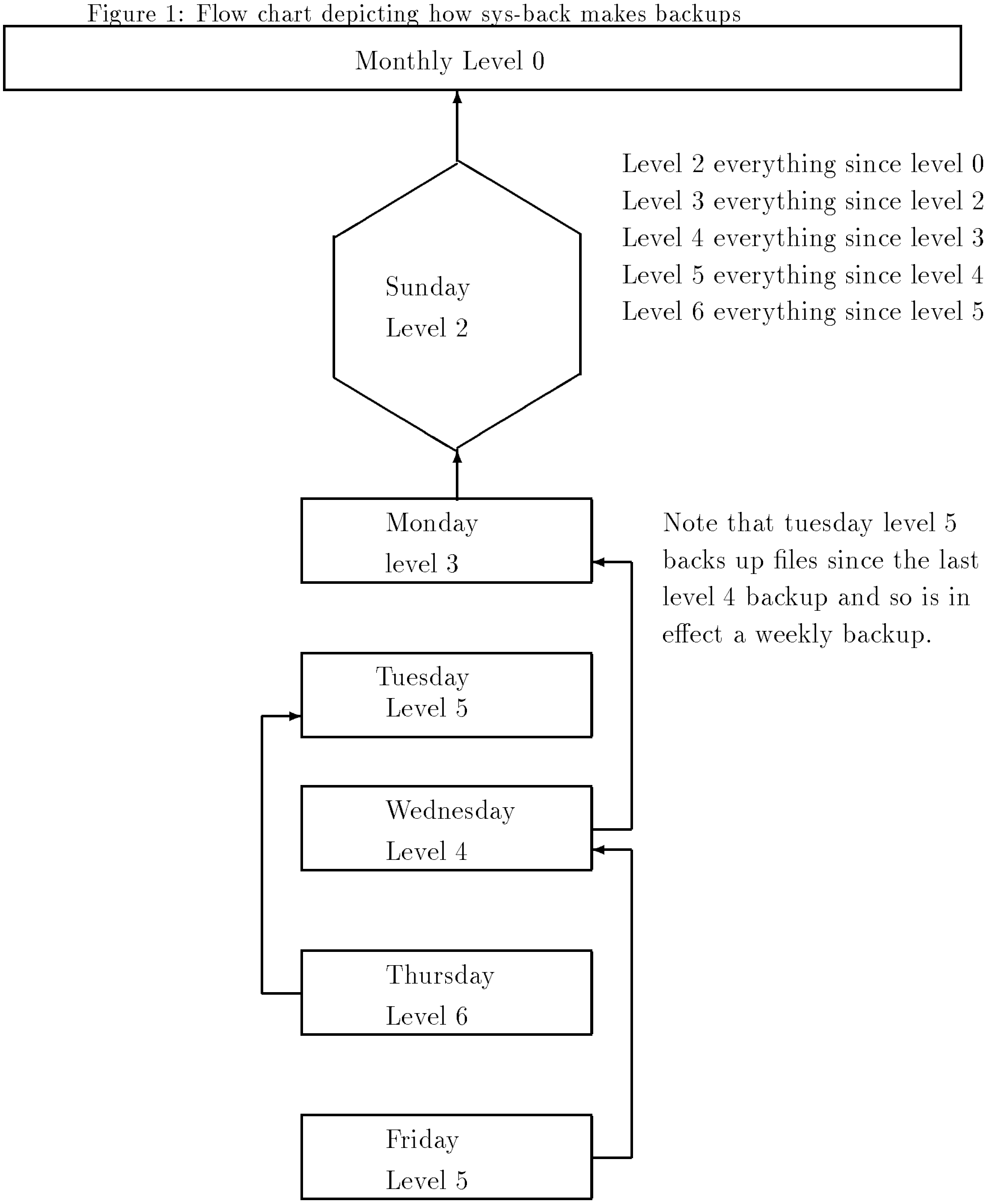
### 1.3 sysback and backup commands

The sysback script is a bourne shell script that is run by the cron daemon every weekday night and sundays. The following figure illustrates the sequence in which the various levels of backups are carried out.
The commands that make up the core of sysback are rdump, dd and rsh. The machine that runs the sys-back command will be refered to as the server from now on. In the case of the Relativity network, helmholtz.ph.utexas.edu is the server and has a 5 GB tape drive on it. On this tape drive helmholtz, einstein, godel, infeld, hoffmann, schild, ricci, landau and lifshitz are all incrementally backed up. To understand how this is done one would have to look at the rdump man page. When sysback has to backup a filesystem, say the /usr filesystem from einstein to helmholtz's tape drive it uses rsh to run rdump on einstein. The command line in the script is
`rsh $1 -l root /usr/etc/rdump $3usf 145000 $DEFHOST:$2 $4`
where $1 is the name of the machine on which the filesystem to be backed up exists. $DEFHOST is the hostname of the server (the machine on which the tape drive is attached to) $2 is the name of the device on the server. In our case that is `/dev/nrst17`. $3 is the level[4] at which to carry out the backup. $4 is the filesystem to be backed up. With this combination of rsh and rdump, sysback backs up all of the systems incrementally to a single tape drive. The idea of levels of backups is illustrated in the previous figure. A level 0 backup is a backup of everything in the given filesystem. A level 2 backup is a backup of everything since the last level 0 backup. Thus for a number $n$ a level $n$ backup backs up everything since the last level $n-1$ backup.

For a level 0 backup systems are backed up in groups. For this purpose I have a level 0 backup script which is a variant of sysback. The current grouping is as follows:
DUET5="ricci infeld hoffmann"
DUET6="einstein godel"
SUNS="helmholtz landau lifshitz schild"

[4] levels of backups are described in the man pages as well as in the book, **"UNIX System Administration Handbook" by Nemeth, Snyder and Seebass**

Figure 1: Flow chart depicting how sys-back makes backups



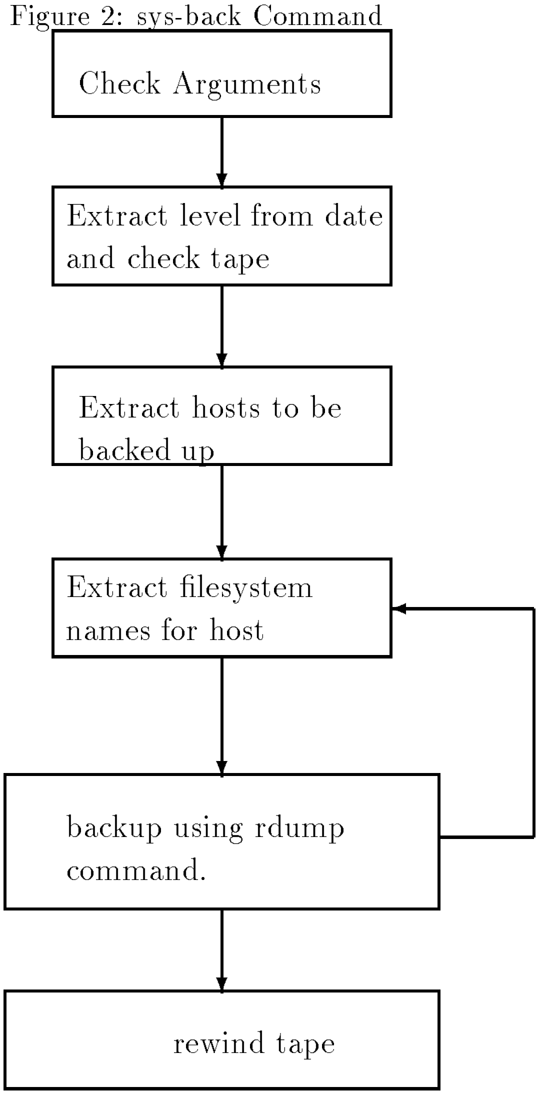
To backup all filesystems at level 0 ricci, infeld and hoffmann type:
`./zeroback duet5 all`
For daily and weekly backups an entry is present in the crontabs on helmholtz.
The entry is in `/d/helmholtz/var/spool/cron/crontabs/root`

```
45 23    /usr/local/adm/sysback/sysback all all
```

The sys-back script runs in the following sequence.

- Checks number of arguments and if not correct display usage.
- Obtains the level of backup to be done from date.
- Checks to see if the tape is at correct level. If not quit.
- Extracts the hosts to be backed up from command argument.
- Extracts the filesystems to be backed up from command argument.
- Begin to write backups to the tape drive.
    1. Uses dd to write a header describing the level, date and filesystem.
    2. Uses rsh and rdump as given above to backup the filesystem.
- Cycles through all the hosts and their filesystems. When it is done the tape is rewound. To better understand backups it would be a good idea to read books on UNIX system administration.
  **Problems/Troubleshooting** sys-back writes all its errors and logs in the /etc/backups directory in backups.log and errors. Generally the backups work smoothly except in the event of network failures or if the /etc/hosts.equiv and .rhosts files are not set up properly. Remember you only have 5 GB of tape, any more will require a rewrite of the script to make sure that it can use multiple tapes.

Figure 2: sys-back Command




sequence of events for sys-back script.