ECMWF user archive
ECFS

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User Support

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Introduction

- **Since 1983, ECMWF has operated a large-scale Data Handling System (DHS), in which all users can store and retrieve data**
- **The Data Handling System consists of three main components:**
  - **IBM's High Performance Storage System (HPSS), used as the underlying archiving system in which data is kept**
  - **MARS - Meteorological Archival and Retrieval System**
    - **GRIB and BUFR data**
    - **over 43 Petabytes in ~10 million files (~4.3 GB/file)**
    - **about 65 Terabytes added daily**
  - **ECFS - ECMWF File Storage system**
    - **Any kind of data**
    - **14.2 Petabytes of data, about 134 Million files (~106 MB/file)**
    - **about 20 Terabytes added daily**

The ECFS client: a Unix-like interface (1/2)

- Files are mapped to a Unix-compatible directory tree
- Either absolute and relative pathnames can be used
- Concept of current ECFS working directories, analogous to the Unix current working directory
- Wildcard characters are supported for (rightmost) ECFS file element of a path but not for directories,
  e.g. you cannot use els ec:directory*/filename.out
- The ECFS file size limit is 32 GB. Be aware that certain Unix systems (not at ECMWF) or software packages cannot handle files over 2 GB in size

The ECFS client: a Unix-like interface (2/2)

- But **this is not a UNIX file system**:
  - Files are migrated off to tape(s) behind the scenes
  - There are overheads when files are transferred to/from ECFS, unless file is on disk cache (small and recent data)
- **ECFS commands:**
  - **els, erm, ermdir, emkdir, ecd, epwd, echmod, echgrp, ecp, emv (and emove), ecat, etest, etouch, eumask and**
  - **ecfsdir, ecfs_status**
- Environment is set up for csh, ksh and bash users

Documentation & availability at ECMWF

- **ECFS commands are available on all ECMWF platforms (ecgate and HPCF systems) except ecfs_status command for monitoring ECFS usage (available on ecgate only)**

- **Documentation is available at**

  www.ecmwf.int/services/computing/docs/archives/ecfs/index.html

- **ECFS man page:**

  man ecfs

- **In addition there are man pages for each specific command e.g.:**

  man els

ECFS domains

- **ECFS files are currently stored in two domains:**
  ec: and ectmp:
  - **ec: permanent domain where files are stored indefinitely. This is the default domain.**
  - **ectmp: temporary domain where files are stored for 90 days, after which they are automatically deleted. Once a file has been automatically deleted it CANNOT be recovered.**

  NB: Co-Operating states may ONLY use domain ectmp:

- **The domain names ec: and ectmp: should be used with all ECFS commands to explicitly indicate which domain to use**

ECFS user commands: Exploring the ECFS file system

- List ECFS files described by target:

```
els [-l] [-1] [-a] [-d] [-R] <target>
```

Target should be prefixed by an ECFS domain either ec: or ectmp:

To list subdirectories recursively.
els can time out for very large ECFS directory trees. (see ecfs_audit file)

- Change the current ECFS working directory for the specified ECFS domain:

```
ecd <target>
```

Sets the value of the current working directory of the specified domain/directory

NB: Defaults to login name of user if target omitted

- Print name of the ECFS current working directory for the specified ECFS domain:

```
   epwd    ec:
or epwd    ectmp:
```

Display the current ECFS working directory for the relevant domain

Practical 1: Exploring the ECFS file system

- **Try the following commands on ecgate:**

```
epwd ec:
epwd ectmp:
```

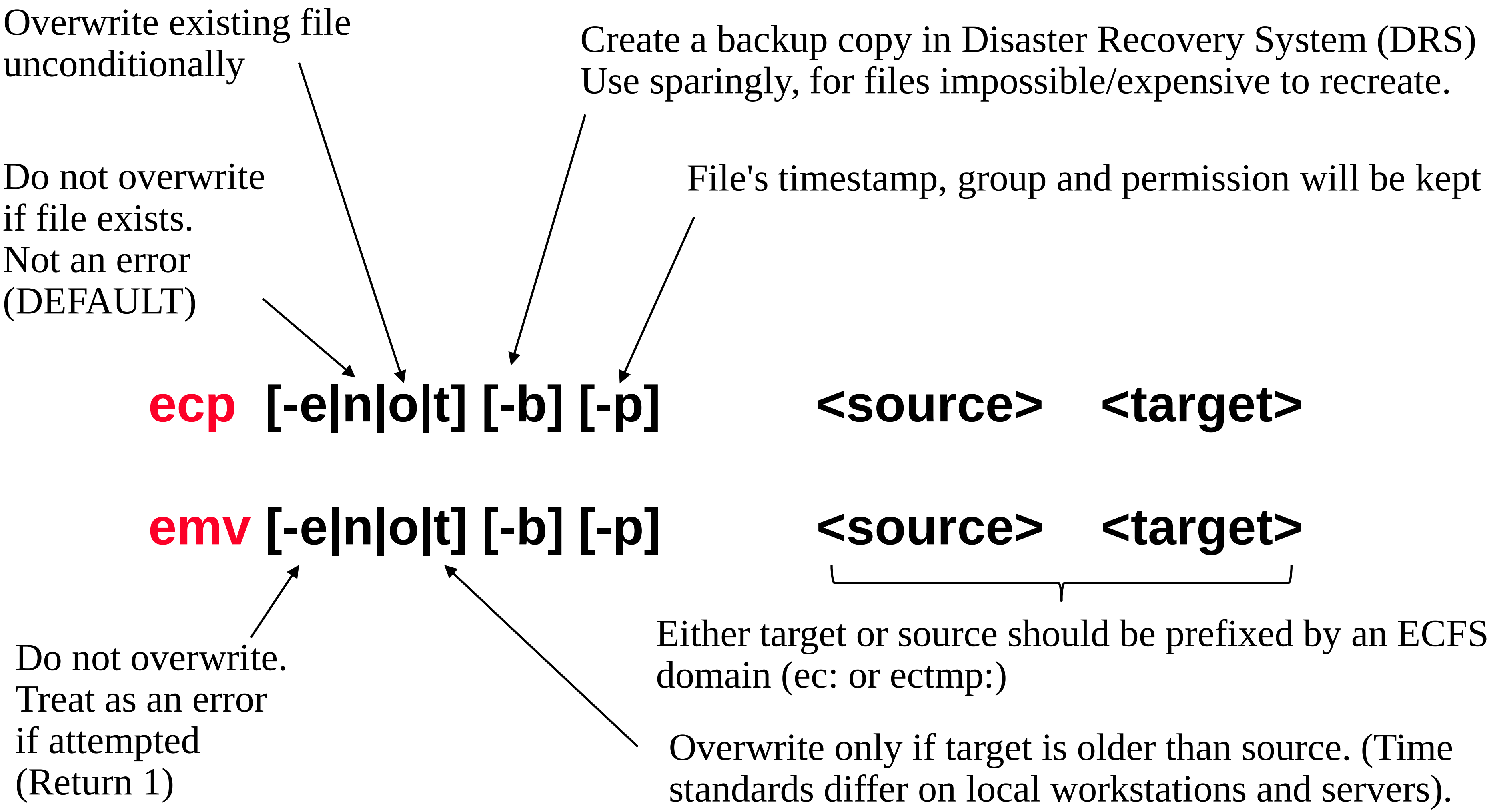
- **Use els to list all the files contained in both domains:**

```
els ec:
els ectmp:
```

- **Change the working directories and use els to list their contents:**

```
ecd ec:/trx
epwd ec:
els ec:
ecd ec:
```

ECFS user commands: Transferring files between ECFS and client storage



Overwrite existing file unconditionally

Create a backup copy in Disaster Recovery System (DRS) Use sparingly, for files impossible/expensive to recreate.

Do not overwrite if file exists. Not an error (DEFAULT)

File's timestamp, group and permission will be kept

ecp [-e|n|o|t] [-b] [-p] <source> <target>

emv [-e|n|o|t] [-b] [-p] <source> <target>

Either target or source should be prefixed by an ECFS domain (ec: or ectmp:)

Do not overwrite. Treat as an error if attempted (Return 1)

Overwrite only if target is older than source. (Time standards differ on local workstations and servers).

NB: emv is similar to ecp but <source> files are removed after being transferred

Example: Transferring files between ECFS and client storage

```
> ecp $SCRATCH/my_file ectmp:Backup/Mar/ecfs_scratch_file
```

Note that ecp will automatically create missing directories in the target path.

```
>  emv ectmp:ecfs_scratch_file $SCRATCH/my_file
```

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Practical 2: ecp and emv

- Work in your $SCRATCH

```
cd $SCRATCH
```

- Create a copy of the practicals directory in your $SCRATCH

```
tar –xvf /scratch/ectrain/trx/ecfs_practicals.tar
```

- Copy the files $SCRATCH/ecfs_practicals/data/file*.out in ectmp:
- Move the file ectmp:file1.out in your $SCRATCH

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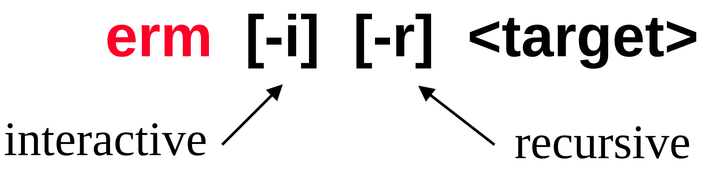
ECFS user commands: File deletion



```
erm [-i] [-r] <target>
```

Target should be prefixed by an ECFS domain either ec: or ectmp: No client files are affected.

```
> erm ec:ecfs_scratch_file
```

erm will not ask for confirmation, unless `–i` is specified

```
> erm ec:test*
```

Files are removed from ECFS with a soft-delete: files will still be kept for currently 30 days during which it will be possible, on request, to un-delete any file that was deleted by mistake. After that period any removal will become permanent.

Please contact us if you have to remove large directory trees

Backup support

- No automatic backup copy is made of ECFS data. Specify the "-b" option on the ECFS commands (ecp, emv, ecfsdir) to request a backup copy to be made:

```
ecp –b myfile ec:essential_data
emv –b myfile ec:essential_data
ecfsdir –b $SCRATCH/results ec:essential_directory
```

- The existence of a backup copy will be indicated by a **b** as the first character of the line listing:

```
br--r----- 1 uid group 512 Nov 19 2003 essential_data
-rw-rw---- 1 uid group 512 Nov 19 2003 non_essential_data
```

- NOTE: Irrespective of the existence of backup copies: any ECFS files removed (deleted) by a user can only be recovered for a limited period of 30 days

ECFS user commands: creation and removal of directories

Creates all the non-existing parent directories first

Specifies the octal file permission mode to be used for new directories. If not present, the ECFS umask (002 by default) is applied

- Make directory:

  emkdir [-p] [-m octal_mode] <target>

- Remove a specified *empty* directory:

  ermdir [-i] <target>

  interactive (request confirmation for each item)

```
>  emkdir –p ectmp:DIR1/DIR2/DIR3

>  ermdir ectmp:DIR1/DIR2/DIR3
```

Delete empty directories only

ECFS user commands: changing permissions

echmod [-R] octal_mode <target>

```
> echmod 640 ec:myecdir
```

- Change the current ECFS eumask: eumask [<umask>]

```
> eumask 022
```

Only numerical values can be used as ECFS umasks. The default ECFS umask is set to 027.

- Change group of file(s): echgrp group <target>

```
> echgrp mysecgrp ec:/uid/*
```

ECFS user commands: save or retrieve a complete Unix directory as one ECFS file

Date and time of last access

Source or Target should be prefixed by an ECFS domain either ec: or ectmp:

ecfsdir [-o] [-b] [-m|-a] <source> <target>

The date/time of last modification will be used as time stamp. This is the default for ecfsdir. Only meaningful at retrieval.

Results is a directory and all the files in Results will be packed into a single file called results_backup

```
>  ecfsdir $SCRATCH/Results  ectmp:Model/results_backup

Results  directory saved
```

NB: ecfsdir uses cpio to “compact” the files

ECFS user commands: save or retrieve a complete Unix directory as one ECFS file

```
>  cat $HOME/ECFS/data_1717.06Mar2011
Contents of the directory saved:
==========================

./DIR1/DIR2/file1
./DIR1/DIR2/DIR3/file2
            .
            .
            .
./DIRn/…/DIRm/filep
.
Name of the directory saved:
/scratch/ectrain/trx/Results

Ecfs backup in :
/trx/mp:Model/results_backup

Date  : Fri  Feb  3 12:19:04 GMT 2006
From : ecgate
```

This file is stored in $HOME/ECFS to give you the list of files/directories saved. However, you can delete this file or move it (it is not needed when retrieving from ECFS).

Practical 3: ecfsdir

- Use ecfsdir to copy the content of the directory $SCRATCH/ecfs_practicals/data in ec:mydata

Faster than the
equivalent ecp

```
> ecfsdir $SCRATCH/ecfs_practicals/data ec:mydata
```

- Check the content of your $HOME/ECFS (search for a file named data_*7Mar2011).

```
> cat $HOME/ECFS/data_*7Mar2011
```

- Then retrieve ec:mydata in your $SCRATCH/ecfs_practicals/mydata

```
> ecfsdir ec:mydata $SCRATCH/ecfs_practicals/mydata
> cd $SCRATCH/ecfs_practicals/mydata
```

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ECFS user commands: renaming/moving files within the same ECFS domain

Source and target should be prefixed by the same ECFS domain (ec: or ectmp:)

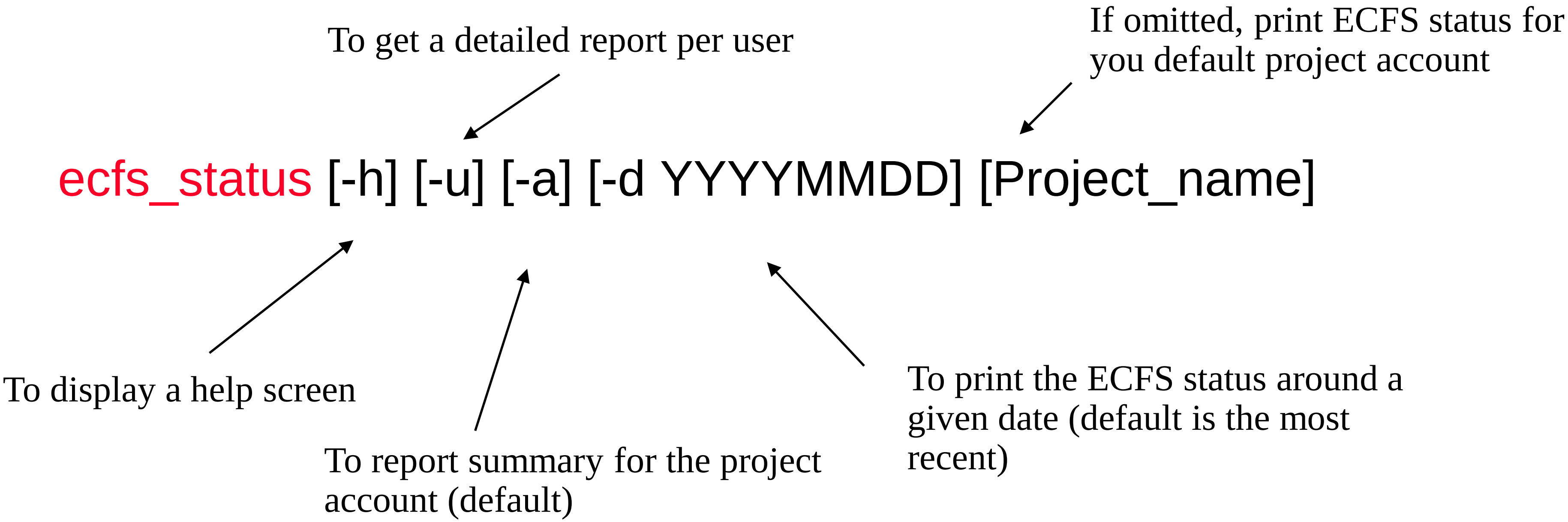
```
emove [-o|t|n|e]   <source>  <target>
```

```
> emove  ectmp:ecfs_file  ectmp:DIR1/ecfs_fileFeb06
```

- DIR1 must exist!
- Not possible to move data between ec: and ectmp: domains

ECFS user commands: monitoring

- The ecfs_status command to be run on ecgate to get the most recent usage by project account



To get a detailed report per user

If omitted, print ECFS status for you default project account

```
ecfs_status [-h] [-u] [-a] [-d YYYYMMDD] [Project_name]
```

To display a help screen

To report summary for the project account (default)

To print the ECFS status around a given date (default is the most recent)

- To get an overview on their ECFS usage, users can also refer to the audit files ec:ecfs_audit and/or ectmp:ecfs_audit.tmp which are created once per month and contain a complete list of a user's files in each ECFS domain

Examples: ECFS monitoring

Client storage
ECFS

- Running ecfs_status on ecgate:

```
> ecfs_status
ECFS status on 20110210 for my_acct
 Account my_acct    Total: 64259322 MB - 1057024 files   Transfer previous month:
                                                         3486719 MB - 23833 files
Total: 64259322 MB -  1057024 files    Transfer previous month:  3486719 MB - 23833 files
```

- To read ecfs_audit or ecfs_audit.tmp, you need first to copy them locally (these two files don’t exist for new accounts; they will be created after the first month)

```
> ecp ec:ecfs_audit   $SCRATCH/ecfs_audit
> cat $SCRATCH/ecfs_audit
-- uid gid          size(bytes)  creation    last_access  path    today= 2011-02-14
* trx  ectrain         1945665  2005-12-16    2005-12-16   /trx/test1
* trx  ectrain         1305088  2005-12-16    2005-12-16   /trx/test2
…
Total files  =20      megabytes = 116.864808082581
total directories = 2 total files not accessed since 20040708 = 0
```

ECFS user commands: copies file between a domain and STDIN/STDOUT

```
ecat -s size [-e][-n][-o][-b]  -  domain:filename
```

```
ecat domain:filename  -
```

ecat is not as resilient as other ECFS commands!

```
> ecat ec:ecfs_audit   -
> -- uid gid          size(bytes)  creation    last_access  path    today= 2011-02-14
* trx  ectrain        1945665  2005-12-16    2005-12-16   /trx/test1
* trx  ectrain        1305088  2005-12-16    2005-12-16   /trx/test2
…
Total files  =20      megabytes = 116.864808082581
total directories = 2 total files not accessed since 20040708 = 0
```

Client storage
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ECFS user commands: Check file attributes

etest [-{option}] <target>

Target should be prefixed by an ECFS domain either ec: or ectmp:

Options are a subset of Unix test.

```
> els -l ec:testfile
-rw-r-----   1 trx     ectrain           29 Mar  4 09:36 testfile
> etest -w ec:testfile && echo writable
writable
```

Recommendations

- Do not copy in/out the same files frequently. Use temporary local disk space such as $SCRATCH to keep a local copy of these files (by default ecp will not overwrite a file if it exists; do not use the –o option in that case)
- Create fewer larger files rather than many small files otherwise it can adversely affect performance of the entire system
  - Find reasonable balance
- Group together what belongs together using ecfsdir or cpio or tar and only then store them into ECFS
- Use ectmp: if files do NOT need to be kept for long periods
- Delete files which you do not need in ec:
- Never use ECFS commands in parallel jobs on HPCF

ECFS within scripts (1/2)

- Error Handling: the following techniques are suggested for trapping ECFS error codes when running batch scripts in the Korn shell environment
  - Set a trap for the entire script:

```
#!/bin/ksh
trap " echo ECFS call exited with RC= \$? " ERR
ecp nofile ec:
```

  - or catch any errors on each call:

```
#!/bin/ksh
set +e
ecp nofile ec:
RC=$?
set -e
if [ $RC -gt 0 ]
then
        echo " ECFS call exited with RC= $RC"
fi
```

To avoid the script to stop after the first error

Check the code returned by the ECFS command

ECFS within scripts (2/2)

- Check existence of a local copy before getting ECFS version of file:

```
#!/bin/ksh
if [ ! -r $SCRATCH/file2.out ]; then
   ecp ec:file2.out $SCRATCH/.
fi
```

Future plans

- **Retrieval optimisation**
- **Introduce concept of lifetime/expiry**
- **Enhance accounting**