Information Literacy

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mobility
data, computation, presence

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networks are good for sharing digital information

e-mail
synchronisation (Dropbox)
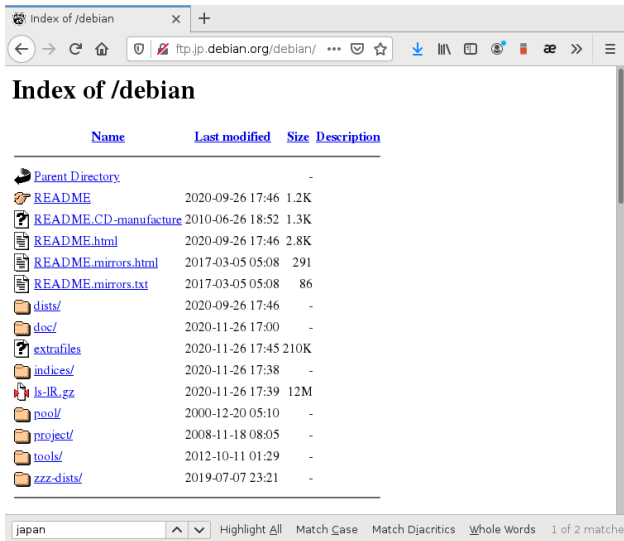network attached storage
network file share (Win)
airdrop (Mac)
peer-to-peer (torrent)
web (mediafire, ...)
file transfer protocol
remote copy/synchronise

the web is easy and convenient for downloads

web server configured to show listings of directories

right-click

`Save link as...`

downloads can be automated

browse to web site

right-click

```
Copy link location
```

type download command

paste copied URL

```
wget http://kuas.org/tmp/planets.tar
curl -O http://kuas.org/tmp/planets.tar
```

3
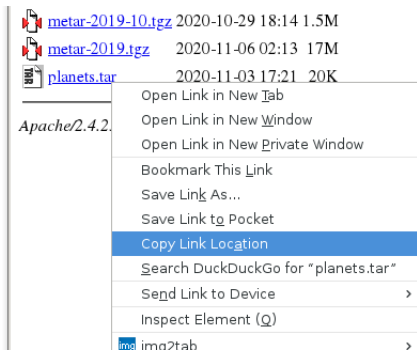
fragmented data poses problems

one click per file

many files ⇒ many clicks

`wget` supports recursion

```
wget -r -np http://kuas.org/tmp/files
```

-r   get directory *recursively*

-np *no parent* ignores anything outside the directory
       (e.g., the parent directory '`..`' in the listing)

uploads and big data pose problems

web servers not designed for large file transfers

upload size limit (like e-mail)

more robust solution: FTP

file transfer protocol and program

- you run the FTP client, which connects to an FTP server
- transfer files to/from the remote server

use `ftp` to log in to an FTP server

```
$ ftp kuas.org
Connected to kuas.org.
220 ProFTPD 1.3.5b Server (Debian) [10.0.1.11]
Name (kuas.org:piumarta): kuasuser
331 Password required for kuasuser
Password: letmein!
230 User kuasuser logged in
Remote system type is UNIX.
Using binary mode to transfer files.
```

use `dir` to list a remote directory

note that the prompt changes to '`ftp>`'

```
ftp> dir
200 PORT command successful
150 Opening ASCII mode data connection for file list
d-wx--x--x 2 kuasuser kuasuser 4096 Nov 25 05:14 incoming
-rw-r--r-- 1 kuasuser 0          10 Nov 26 07:09 test.txt
226 Transfer complete
```

other useful commands:
   cd   change remote directory
   pwd print remote directory

use `get` and `put` to transfer files

use '`bin`' to enable binary mode, if required

use '`get` *filename*' to download a file (to your machine)

use '`put` *filename*' to upload (to the remote machine)

```
ftp> bin
200 Type set to I
ftp> get test.txt
local: test.txt remote: test.txt
200 PORT command successful
150 Opening BINARY mode data connection for test.txt
226 Transfer complete
10 bytes received in 0.00 secs (41.0320 kB/s)
```

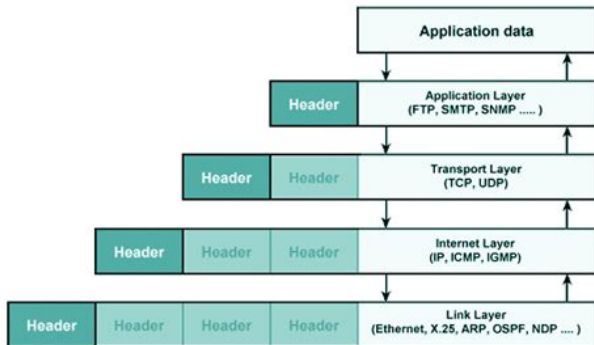## use **bye** to quit the FTP program

```
ftp> bye
221 Goodbye.
$ ls -l test.txt
-rw-r--r-- 1 piumarta piumarta 10 Nov 26 11:55 test.txt
$
```

note: most web browsers can connect to FTP servers

- use **ftp:**`//directory/path` as the address
  (instead of the usual `http://...`)
- you will see a directory listing in the browser
- click on files to download them

FTP uses TCP to provide reliable file transfer

application provides user interface with commands, directory listings, file content transfers, etc.

FTP data encodes **application** commands; header tells FTP server how to interpret data

TCP reliably **transports** FTP data between two programs (FTP server/client)

IP unreliably exchanges TCP data between two **Internet** computers

frames unreliably exchange IP packets between directly **linked** devices

secure shell (ssh) lets you log into a remote computer

ssh client

ssh server

tcp   ssh   tcp

✗ network connection is encrypted by ssh

sniffer
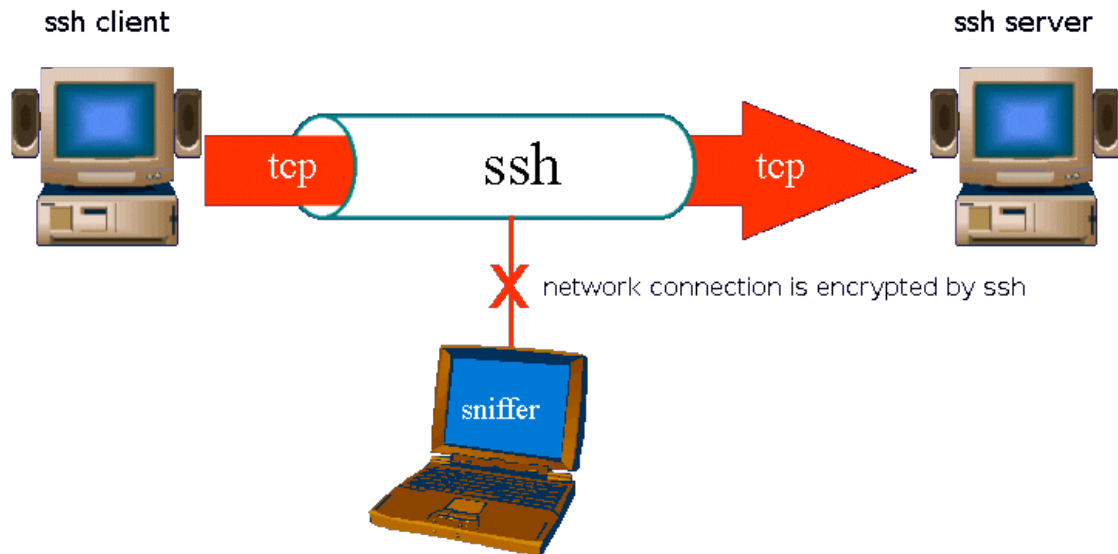
secure shell (ssh) lets you log into a remote computer

```
$ ssh -p 2211 kuas.org
Linux io 4.9.0-11-amd64 #1 SMP Debian 4.9.189-3+deb9u2 (2019-
Last login: Fri Nov 27 02:19:35 2020 from 144.172.74.103
piumarta@io:~$ cd /home/kuasuser
piumarta@io:/home/kuasuser$ ls -l
total 12
drwxr-xr-x 2 kuasuser www-data 4096 Nov 27 01:29 files
d-wx--x--x 2 kuasuser kuasuser 4096 Nov 27 02:21 incoming
-rw-r--r-- 1 kuasuser root       10 Nov 26 16:09 test.txt
piumarta@io:/home/kuasuser$ exit
logout
Connection to kuas.org closed.
```

use 'scp' instead of FTP for security

a remote path describes a file on another computer

    user @ address : path

the *path* part is absolute or relative to your home directory

    kuasuser @ kuas.org : test.txt

```
scp remotefile localname
scp localfile remotename
```

to copy directories, use -r (recursive)

use 'scp' instead of FTP for security

```
$ scp –P 2211 kuasuser@kuas.org:test.txt .
kuasuser@kuas.org's password: letmein!
test.txt       100%   10     11.0KB/s   00:00

$ scp –r –P 2211 kuasuser@kuas.org:files .
kuasuser@kuas.org's password: letmein!
02-two.txt     100%    4      3.7KB/s    00:00
01-one.txt     100%    4      3.9KB/s    00:00
03-three.txt 100%     10     12.5KB/s    00:00
```

for security kuas.org uses port 2211 for `ssh` and `scp`

- use 'ssh –p 2211' and 'scp –P 2211'

`rsync` mirrors (synchronises) directories

`rsync` is like `scp` but it only copies *changes*

- initial copy is normal speed (same as `scp`)

- after that, `rsync` is *much* faster than `scp`

remote file names have the same syntax as `scp`

```
$ rsync -vr piumarta@kuas.org:public_html/tmp html
sent 123 bytes  received 18.9 Mbytes  12.6 Mbytes/sec
total size is 18,878,621  speedup is 1.00
$ rsync -vr piumarta@kuas.org:public_html/tmp html
sent 52.5 kbytes  received 35.3 kbytes  58.5 kbytes/sec
total size is 18,878,621  speedup is 215.16
```
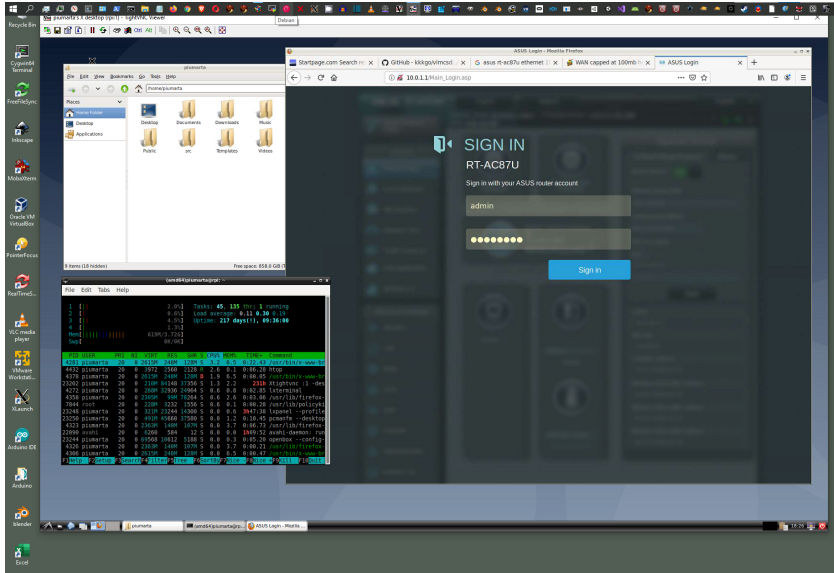
VNC displays a remote desktop in a local window

Windows 10 with an open VNC window connected to a remote Raspberry Pi displaying its Debian Linux graphical desktop

remote desktop has many uses

managing virtual servers in a data centre

accessing the console on a local virtual machine

- VMWare, VirtualBox, etc.

using graphical applications on remote workstations

online virtual gaming

- powerful graphics cards can now be 'virtualised'

summary

move files (data) around
- browser, FTP, `scp`, `rsync`

move yourself (computation) around
- `ssh`, VNC

HTTP

exercise

1. use `scp` (or `ftp`) to copy this file to your computer:
    `kuasuser@kuas.org:exercise.txt`
   (the password is: 'letmein!')

2. rename the file to **your** student ID; e.g.
    `mv exercise.txt 2020m666.txt`

3. edit the file, follow the instructions, then save the file

4. use `scp` (or `ftp`) to upload the file to kuas.org/incoming

   `scp 2020m666.txt kuasuser@kuas.org:incoming/.`