Redes de Computadores 2020/2021

Introdução ao Projecto: "RC Two Factor Authentication"

```
AS: sigma03.ist.utl.pt
$ ./AS -p 58000 -v
```

```
AS: sigma03.ist.utl.pt
$ ./AS -p 58000 -v
```

```
PD: sigma02.ist.utl.pt $
```

```
PD: sigma02.ist.utl.pt

$/PD sigma02 -d 57000
   -n sigma03 -p 58000
>
```

```
AS: sigma03.ist.utl.pt
$ ./AS -p 58000 -v
```

PD, User, AS, FS

```
PD: sigma02.ist.utl.pt

$/PD sigma02 -d 57000
-n sigma03 -p 58000
```

AS: sigma03.ist.utl.pt \$./AS -p 58000 -v

PD, User, AS, FS

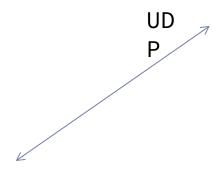
> reg 12345 password

```
PD: sigma02.ist.utl.pt

$/PD sigma02 -d 57000
-n sigma03 -p 58000
```

AS: sigma03.ist.utl.pt \$./AS -p 58000 -v

PD, User, AS, FS



```
PD: sigma02.ist.utl.pt
```

```
$/PD sigma02 -d 57000
-n sigma03 -p 58000
> reg 12345 password
```

```
AS: sigma03.ist.utl.pt
```

```
$ ./AS -p 58000 -v
```

FS: sigma04.ist.utl.pt

```
$ ./FS -q 59000
-n sigma03 -p 58000 -v
```

```
AS: sigma03.ist.utl.pt
                    UD
                                  $ ./AS -p 58000 -v
REG 12345 password signa02 57000\n
PD: sigma02.ist.utl.pt
 $/PD sigma02 -d 57000
    -n sigma03 -p 58000
   reg 12345 password
```

```
FS: sigma04.ist.utl.pt
$ ./FS -q 59000
          -n sigma03 -p 58000 -v
```

```
FS: sigma04.ist.utl.pt
$ ./FS -q 59000
          -n sigma03 -p 58000 -v
```

```
### AS: sigma03.ist.utl.pt

| $ ./AS -p 58000 -v |
| PD: new user, UID=12345 |
| $ /PD sigma02 -d 57000 |
| -n sigma03 -p 58000 |
| > reg 12345 password |
```

```
FS: sigma04.ist.utl.pt

$ ./FS -q 59000
          -n sigma03 -p 58000 -v
```

PD, User, AS, FS

```
AS: sigma03.ist.utl.pt
                    UD
                                  $ ./AS -p 58000 -v
                                   PD: new user, UID=12345
REG 12345 password signa02 57000\n
RRG OK\n
PD: sigma02.ist.utl.pt
 $ /PD sigma02 -d 57000
   -n sigma03 -p 58000
> reg 12345 password
   Registration
successful
                               User: sigma01.ist.utl.pt
                                 $
```

PD, User, AS, FS

```
AS: sigma03.ist.utl.pt
                    UD
                                  $ ./AS -p 58000 -v
                                   PD: new user, UID=12345
REG 12345 password sigma02 57000\n
RRG OK\n
PD: sigma02.ist.utl.pt
 $./PD sigma02 -d 57000
   -n sigma03 -p 58000
> reg 12345 password
   Registration
successful
                               User: sigma01.ist.utl.pt
                                 $./User -n sigma03 -p 58000
                                         -m sigma04 -q 59000
```

```
FS: sigma04.ist.utl.pt
 $ ./FS -q 59000
        -n sigma03 -p 58000 -v
```

```
AS: sigma03.ist.utl.pt
                    UD
                                  $ ./AS -p 58000 -v
                                   PD: new user, UID=12345
REG 12345 password sigma02 57000\n
RRG OK\n
PD: sigma02.ist.utl.pt
                           TCP
 $./PD sigma02 -d 57000
    -n sigma03 -p 58000
> reg 12345 password
   Registration
successful
                               User: sigma01.ist.utl.pt
                                 $./User -n sigma03 -p 58000
                                         -m sigma04 -q 59000
Ex: sigma01 = 193.136.128.108
```

```
FS: sigma04.ist.utl.pt
$ ./FS -q 59000
          -n sigma03 -p 58000 -v
```

```
AS: sigma03.ist.utl.pt
                    UD
                                  $ ./AS -p 58000 -v
                                   PD: new user, UID=12345
REG 12345 password sigma02 57000\n
RRG OK\n
PD: sigma02.ist.utl.pt
                           TCP
 $./PD sigma02 -d 57000
    -n sigma03 -p 58000
> reg 12345 password
   Registration
successful
                               User: sigma01.ist.utl.pt
                                 $./User -n sigma03 -p 58000
                                         -m sigma04 -q 59000
                                > login 12345 password
Ex: sigma01 = 193.136.128.108
```

```
AS: sigma03.ist.utl.pt
                    UD
                                  $ ./AS -p 58000 -v
                                   PD: new user, UID=12345
REG 12345 password sigma02 57000\n
RRG OK\n
PD: sigma02.ist.utl.pt
                                 LOG 12345 password\n
 $./PD sigma02 -d 57000
    -n sigma03 -p 58000
 > reg 12345 password
   Registration
 successful
                               User: sigma01.ist.utl.pt
                                 $./User -n sigma03 -p 58000
                                         -m sigma04 -q 59000
                                > login 12345 password
Ex: sigma01 = 193.136.128.108
```

```
AS: sigma03.ist.utl.pt
                    UD
                                  $ ./AS -p 58000 -v
                                   PD: new user, UID=12345
REG 12345 password sigma02 57000\n
                                   User: login ok, UID=12345
RRG OK\n
PD: sigma02.ist.utl.pt
                                 LOG 12345 password\n
 $./PD sigma02 -d 57000
    -n sigma03 -p 58000
 > reg 12345 password
   Registration
 successful
                               User: sigma01.ist.utl.pt
                                 $./User -n sigma03 -p 58000
                                         -m sigma04 -q 59000
                                 > login 12345 password
Ex: sigma01 = 193.136.128.108
```

```
AS: sigma03.ist.utl.pt
                    UD
                                  $ ./AS -p 58000 -v
                                   PD: new user, UID=12345
REG 12345 password sigma02 57000\n
                                   User: login ok, UID=12345
RRG OK\n
PD: sigma02.ist.utl.pt
                                 LOG 12345 password\n
 $./PD sigma02 -d 57000
                           TCP
                                 RLO OK\n
    -n sigma03 -p 58000
> reg 12345 password
   Registration
successful
                               User: sigma01.ist.utl.pt
                                 $./User -n sigma03 -p 58000
                                         -m sigma04 -q 59000
                                > login 12345 password
Ex: sigma01 = 193.136.128.108
```

```
AS: sigma03.ist.utl.pt
                    UD
                                  $ ./AS -p 58000 -v
                                   PD: new user, UID=12345
REG 12345 password sigma02 57000\n
                                   User: login ok, UID=12345
RRG OK\n
PD: sigma02.ist.utl.pt
                                 LOG 12345 password\n
 $./PD sigma02 -d 57000
                           TCP
                                 RLO OK\n
    -n sigma03 -p 58000
> reg 12345 password
   Registration
successful
                               User: sigma01.ist.utl.pt
                                 $./User -n sigma03 -p 58000
                                         -m sigma04 -q 59000
                                > login 12345 password
                                    You are now logged in.
                                  >
Ex: sigma01 = 193.136.128.108
```

```
AS: sigma03.ist.utl.pt
                    UD
                                  $ ./AS -p 58000 -v
                                   PD: new user, UID=12345
REG 12345 password sigma02 57000\n
                                   User: login ok, UID=12345
RRG OK\n
PD: sigma02.ist.utl.pt
                                 LOG 12345 password\n
 $./PD sigma02 -d 57000
                           TCP
                                 RLO OK\n
    -n sigma03 -p 58000
> reg 12345 password
   Registration
successful
                               User: sigma01.ist.utl.pt
                                 $./User -n sigma03 -p 58000
                                         -m sigma04 -q 59000
                                > login 12345 password
                                    You are now logged in.
                                  > req U f1.txt
Ex: sigma01 = 193.136.128.108
```

```
AS: sigma03.ist.utl.pt
                    UD
                                  $ ./AS -p 58000 -v
                                   PD: new user, UID=12345
REG 12345 password sigma02 57000\n
                                   User: login ok, UID=12345
RRG OK\n
PD: sigma02.ist.utl.pt
                                 LOG 12345 password\n
 $./PD sigma02 -d 57000
                           TCP
                                 RLO OK\n
    -n sigma03 -p 58000
                                REQ 12345 7654 U f1.txt\n
> reg 12345 password
   Registration
successful
                               User: sigma01.ist.utl.pt
                                 $./User -n sigma03 -p 58000
                                         -m sigma04 -q 59000
                                > login 12345 password
                                    You are now logged in.
                                  > req U f1.txt
Ex: sigma01 = 193.136.128.108
```

```
AS: sigma03.ist.utl.pt
                    UD
                                  $ ./AS -p 58000 -v
                                   PD: new user, UID=12345
REG 12345 password sigma02 57000\n
                                   User: login ok, UID=12345
RRG OK\n
                                  User: upload req, UID=12345
                                         file: f1.txt, RID=7654
                                        VC=9987
PD: sigma02.ist.utl.pt
                                 LOG 12345 password\n
 $./PD sigma02 -d 57000
                           TCP
                                 RLO OK\n
    -n sigma03 -p 58000
                                REQ 12345 7654 U f1.txt\n
> reg 12345 password
   Registration
successful
                               User: sigma01.ist.utl.pt
                                 $./User -n sigma03 -p 58000
                                         -m sigma04 -q 59000
                                > login 12345 password
                                    You are now logged in.
                                  > req U f1.txt
Ex: sigma01 = 193.136.128.108
```

PD, User, AS, FS

```
AS: sigma03.ist.utl.pt
                    UD
                                  $ ./AS -p 58000 -v
                                   PD: new user, UID=12345
REG 12345 password signa02 57000\n
                                   User: login ok, UID=12345
RRG OK\n
                                  User: upload req, UID=12345
VLC 12345 9987 U f1.txt\n
                                         file: f1.txt, RID=7654
                                        VC=9987
PD: sigma02.ist.utl.pt
                                 LOG 12345 password\n
 $./PD sigma02 -d 57000
                           TCP
                                 RLO OK\n
    -n sigma03 -p 58000
                                REQ 12345 7654 U f1.txt\n
> reg 12345 password
   Registration
successful
                               User: sigma01.ist.utl.pt
                                 $./User -n sigma03 -p 58000
                                         -m sigma04 -q 59000
                                > login 12345 password
                                    You are now logged in.
                                  > req U f1.txt
```

```
AS: sigma03.ist.utl.pt
                    UD
                                  $ ./AS -p 58000 -v
                                   PD: new user, UID=12345
REG 12345 password signa02 57000\n
                                   User: login ok, UID=12345
RRG OK\n
                                  User: upload req, UID=12345
VLC 12345 9987 U f1.txt\n
                                         file: f1.txt, RID=7654
                                        VC=9987
PD: sigma02.ist.utl.pt
                                 LOG 12345 password\n
 $./PD sigma02 -d 57000
                           TCP
                                 RLO OK\n
    -n sigma03 -p 58000
                                REQ 12345 7654 U f1.txt\n
> reg 12345 password
   Registration
syccessful upload: f1.txt
                               User: sigma01.ist.utl.pt
                                 $./User -n sigma03 -p 58000
                                         -m sigma04 -q 59000
                                > login 12345 password
                                    You are now logged in.
                                  > req U f1.txt
Ex: sigma01 = 193.136.128.108
```

```
AS: sigma03.ist.utl.pt
                    UD
                                  $ ./AS -p 58000 -v
                                   PD: new user, UID=12345
REG 12345 password signa02 57000\n
                                   User: login ok, UID=12345
RRG OK\n
                                   User: upload req, UID=12345
VLC 12345 9987 U f1.txt\n
                                         file: f1.txt, RID=7654
RVC OK\n
                                         VC=9987
PD: sigma02.ist.utl.pt
                                 LOG 12345 password\n
 $./PD sigma02 -d 57000
                           TCP
                                 RLO OK\n
    -n sigma03 -p 58000
                                REQ 12345 7654 U f1.txt\n
> reg 12345 password
   Registration
syccessful upload: f1.txt
                               User: sigma01.ist.utl.pt
                                 $./User -n sigma03 -p 58000
                                         -m sigma04 -q 59000
                                > login 12345 password
                                    You are now logged in.
                                  > req U f1.txt
Ex: sigma01 = 193.136.128.108
```

PD, User, AS, FS

```
AS: sigma03.ist.utl.pt
                    UD
                                  $ ./AS -p 58000 -v
                                   PD: new user, UID=12345
REG 12345 password signa02 57000\n
                                   User: login ok, UID=12345
RRG OK\n
                                  User: upload req, UID=12345
VLC 12345 9987 U f1.txt\n
                                         file: f1.txt, RID=7654
RVC OK\n
                                         VC=9987
PD: sigma02.ist.utl.pt
                                 LOG 12345 password\n
 $./PD sigma02 -d 57000
                           TCP
                                 RLO OK\n
    -n sigma03 -p 58000
                                REQ 12345 7654 U f1.txt\n
> reg 12345 password
                                 RRQ OK\n
   Registration
syccessful upload: f1.txt
                               User: sigma01.ist.utl.pt
                                 $./User -n sigma03 -p 58000
                                         -m sigma04 -q 59000
                                 > login 12345 password
                                    You are now logged in.
                                  > req U f1.txt
```

PD, User, AS, FS

```
AS: sigma03.ist.utl.pt
                    UD
                                  $ ./AS -p 58000 -v
                                   PD: new user, UID=12345
REG 12345 password sigma02 57000\n
                                   User: login ok, UID=12345
RRG OK\n
                                  User: upload req, UID=12345
VLC 12345 9987 U f1.txt\n
                                         file: f1.txt, RID=7654
RVC OK\n
                                        VC=9987
PD: sigma02.ist.utl.pt
                                 LOG 12345 password\n
 $./PD sigma02 -d 57000
                           TCP
                                 RLO OK\n
   -n sigma03 -p 58000
                                REQ 12345 7654 U f1.txt\n
> reg 12345 password
                                 RRQ OK\n
   Registration
syccessful upload: f1.txt
                               User: sigma01.ist.utl.pt
                                 $./User -n sigma03 -p 58000
                                         -m sigma04 -q 59000
      user checks when the
                                > login 12345 password
      validation code (VC) is
                                    You are now logged in.
      received in the PD
                                  > req U f1.txt
                                 >
```

PD, User, AS, FS

```
AS: sigma03.ist.utl.pt
                    UD
                                  $ ./AS -p 58000 -v
                                   PD: new user, UID=12345
REG 12345 password signa@2 57000\n
                                   User: login ok, UID=12345
RRG OK\n
                                   User: upload req, UID=12345
VLC 12345 9987 U f1.txt\n
                                         file: f1.txt, RID=7654
RVC OK\n
                                         VC=9987
PD: sigma02.ist.utl.pt
                                 LOG 12345 password\n
 $./PD sigma02 -d 57000
                           TCP
                                 RLO OK\n
    -n sigma03 -p 58000
                                REQ 12345 7654 U f1.txt\n
                                 RRQ OK\n
> reg 12345 password
   Registration
syccessful upload: f1.txt
                               User: sigma01.ist.utl.pt
                                 $./User -n sigma03 -p 58000
                                         -m sigma04 -q 59000
      user checks when the
                                > login 12345 password
      validation code (VC) is
                                    You are now logged in.
      received in the PD
                                  > req U f1.txt
                                 > val 9987
```

PD, User, AS, FS

```
AS: sigma03.ist.utl.pt
                    UD
                                  $ ./AS -p 58000 -v
                                   PD: new user, UID=12345
REG 12345 password sigma02 57000\n
                                   User: login ok, UID=12345
RRG OK\n
                                  User: upload req, UID=12345
VLC 12345 9987 U f1.txt\n
                                         file: f1.txt, RID=7654
RVC OK\n
                                        VC=9987
PD: sigma02.ist.utl.pt
                                 LOG 12345 password\n
 $./PD sigma02 -d 57000
                           TCP
                                 RLO OK\n
   -n sigma03 -p 58000
                                REQ 12345 7654 U f1.txt\n
> reg 12345 password
                                 RRQ OK\n
                                AUT 12345 7654 9987\n
   Registration
syccessful upload: f1.txt
                               User: sigma01.ist.utl.pt
                                 $./User -n sigma03 -p 58000
                                         -m sigma04 -q 59000
      user checks when the
                                > login 12345 password
      validation code (VC) is
                                    You are now logged in.
      received in the PD
                                  > req U f1.txt
                                 > val 9987
```

PD, User, AS, FS

```
AS: sigma03.ist.utl.pt
                    UD
                                  $ ./AS -p 58000 -v
                                   PD: new user, UID=12345
REG 12345 password sigma02 57000\n
                                   User: login ok, UID=12345
RRG OK\n
                                   User: upload req, UID=12345
VLC 12345 9987 U f1.txt\n
                                         file: f1.txt, RID=7654
RVC OK\n
                                         VC=9987
                                  User: UID=12345
                                         U, f1.txt, TID=2020
PD: sigma02.ist.utl.pt
                                 LOG 12345 password\n
 $./PD sigma02 -d 57000
                           \mathsf{TCP}
                                 RLO OK\n
    -n sigma03 -p 58000
                                 REQ 12345 7654 U f1.txt\n
> reg 12345 password
                                 RRQ OK\n
                                 AUT 12345 7654 9987\n
   Registration
syccessful upload: f1.txt
                                User: sigma01.ist.utl.pt
                                 $./User -n sigma03 -p 58000
                                         -m sigma04 -q 59000
      user checks when the
                                 > login 12345 password
      validation code (VC) is
                                    You are now logged in.
      received in the PD
                                  > req U f1.txt
                                  > val 9987
```

PD, User, AS, FS

```
AS: sigma03.ist.utl.pt
                    UD
                                  $ ./AS -p 58000 -v
                                   PD: new user, UID=12345
REG 12345 password sigma02 57000\n
                                   User: login ok, UID=12345
RRG OK\n
                                   User: upload req, UID=12345
VLC 12345 9987 U f1.txt\n
                                         file: f1.txt, RID=7654
RVC OK\n
                                         VC=9987
                                   User: UID=12345
                                         U, f1.txt, TID=2020
PD: sigma02.ist.utl.pt
                                 LOG 12345 password\n
 $./PD sigma02 -d 57000
                           \mathsf{TCP}
                                  RLO OK\n
    -n sigma03 -p 58000
                                 REQ 12345 7654 U f1.txt\n
> reg 12345 password
                                  RRQ OK\n
                                 AUT 12345 7654 9987\n
   Registration
                                 RAU 2020\n
SIVE 298701 upload: f1.txt
                                User: sigma01.ist.utl.pt
                                  $./User -n sigma03 -p 58000
                                         -m sigma04 -q 59000
      user checks when the
                                 > login 12345 password
      validation code (VC) is
                                    You are now logged in.
      received in the PD
                                  > req U f1.txt
                                  > val 9987
```

```
AS: sigma03.ist.utl.pt
                    UD
                                  $ ./AS -p 58000 -v
                                    PD: new user, UID=12345
REG 12345 password sigma02 57000\n
                                   User: login ok, UID=12345
RRG OK\n
                                   User: upload req, UID=12345
VLC 12345 9987 U f1.txt\n
                                         file: f1.txt, RID=7654
RVC OK\n
                                         VC=9987
                                   User: UID=12345
                                         U, f1.txt, TID=2020
PD: sigma02.ist.utl.pt
                                 LOG 12345 password\n
 $./PD sigma02 -d 57000
                           \mathsf{TCP}
                                  RLO OK\n
    -n sigma03 -p 58000
                                 REQ 12345 7654 U f1.txt\n
> reg 12345 password
                                  RRQ OK\n
                                 AUT 12345 7654 9987\n
   Registration
                                 RAU 2020\n
SIVE 298701 upload: f1.txt
                                User: sigma01.ist.utl.pt
                                  $./User -n sigma03 -p 58000
                                         -m sigma04 -q 59000
      user checks when the
                                 > login 12345 password
      validation code (VC) is
                                    You are now logged in.
      received in the PD
                                  > req U f1.txt
                                  > val 9987
                                    Authenticated! (TID=2020)
                                  >
Ex: sigma01 = 193.136.128.108
```

PD, User, AS, FS

```
AS: sigma03.ist.utl.pt
                    UD
                                  $ ./AS -p 58000 -v
                                   PD: new user, UID=12345
REG 12345 password sigma02 57000\n
                                   User: login ok, UID=12345
RRG OK\n
                                   User: upload req, UID=12345
VLC 12345 9987 U f1.txt\n
                                         file: f1.txt, RID=7654
RVC OK\n
                                         VC=9987
                                   User: UID=12345
                                         U, f1.txt, TID=2020
PD: sigma02.ist.utl.pt
                                 LOG 12345 password\n
 $./PD sigma02 -d 57000
                           \mathsf{TCP}
                                  RLO OK\n
   -n sigma03 -p 58000
                                 REQ 12345 7654 U f1.txt\n
> reg 12345 password
                                  RRQ OK\n
                                 AUT 12345 7654 9987\n
   Registration
                                 RAU 2020\n
SIVE 298701 upload: f1.txt
                                User: sigma01.ist.utl.pt
                                  $./User -n sigma03 -p 58000
                                         -m sigma04 -q 59000
      user checks when the
                                 > login 12345 password
      validation code (VC) is
                                    You are now logged in.
      received in the PD
                                  > req U f1.txt
                                  > val 9987
                                    Authenticated! (TID=2020)
                                  > upload f1.txt
```

PD, User, AS, FS

```
AS: sigma03.ist.utl.pt
                    UD
                                  $ ./AS -p 58000 -v
                                   PD: new user, UID=12345
REG 12345 password sigma02 57000\n
                                   User: login ok, UID=12345
RRG OK\n
                                   User: upload req, UID=12345
VLC 12345 9987 U f1.txt\n
                                         file: f1.txt, RID=7654
RVC OK\n
                                         VC=9987
                                  User: UID=12345
                                         U, f1.txt, TID=2020
                                                                     FS: sigma04.ist.utl.pt
PD: sigma02.ist.utl.pt
                                 LOG 12345 password\n
                                                                      $ ./FS -a 59000
 $./PD sigma02 -d 57000
                           \mathsf{TCP}
                                 RLO OK\n
                                                                             -n sigma03 -p 58000 -v
   -n sigma03 -p 58000
                                 REQ 12345 7654 U f1.txt\n
> reg 12345 password
                                 RRQ OK\n
                                 AUT 12345 7654 9987\n
   Registration
                                 RAU 2020\n
SIVE 298701 upload: f1.txt
                               User: sigma01.ist.utl.pt
                                                                TCP
                                 $./User -n sigma03 -p 58000
                                         -m sigma04 -q 59000
      user checks when the
                                 > login 12345 password
      validation code (VC) is
                                    You are now logged in.
      received in the PD
                                  > req U f1.txt
                                  > val 9987
                                    Authenticated! (TID=2020)
                                  > upload f1.txt
```

PD, User, AS, FS

```
AS: sigma03.ist.utl.pt
                    UD
                                  $ ./AS -p 58000 -v
                                   PD: new user, UID=12345
REG 12345 password sigma02 57000\n
                                   User: login ok, UID=12345
RRG OK\n
                                   User: upload req, UID=12345
VLC 12345 9987 U f1.txt\n
                                         file: f1.txt, RID=7654
RVC OK\n
                                         VC=9987
                                  User: UID=12345
                                         U, f1.txt, TID=2020
                                                                    FS: sigma04.ist.utl.pt
PD: sigma02.ist.utl.pt
                                 LOG 12345 password\n
                                                                      $ ./FS -a 59000
 $./PD sigma02 -d 57000
                           \mathsf{TCP}
                                 RLO OK\n
                                                                             -n sigma03 -p 58000 -v
    -n sigma03 -p 58000
                                 REQ 12345 7654 U f1.txt\n
> reg 12345 password
                                 RRQ OK\n
                                 AUT 12345 7654 9987\n
   Registration
                                 RAU 2020\n
SIVE 298701 upload: f1.txt
                               User: sigma01.ist.utl.pt
                                                                TCP
                                 $./User -n sigma03 -p 58000
                                                                    UPL 12345 2020 f1.txt 6 Hello!\n
                                         -m sigma04 -q 59000
      user checks when the
                                 > login 12345 password
      validation code (VC) is
                                    You are now logged in.
      received in the PD
                                  > req U f1.txt
                                 > val 9987
                                    Authenticated! (TID=2020)
                                  > upload f1.txt
```

PD, User, AS, FS

```
AS: sigma03.ist.utl.pt
                    UD
                                  $ ./AS -p 58000 -v
                                    PD: new user, UID=12345
REG 12345 password signa02 57000\n
                                   User: login ok, UID=12345
RRG OK\n
                                   User: upload req, UID=12345
VLC 12345 9987 U f1.txt\n
                                         file: f1.txt, RID=7654
RVC OK\n
                                         VC=9987
                                  User: UID=12345
                                         U, f1.txt, TID=2020
                                                                     FS: sigma04.ist.utl.pt
PD: sigma02.ist.utl.pt
                                 LOG 12345 password\n
                                                                      $ ./FS -q 59000
 $./PD sigma02 -d 57000
                           \mathsf{TCP}
                                 RLO OK\n
                                                                             -n sigma03 -p 58000 -v
    -n sigma03 -p 58000
                                 REO 12345 7654 U f1.txt\n
                                                                     UID=12345: upload f1.txt (6 Bytes)
> reg 12345 password
                                 RRQ OK\n
                                 AUT 12345 7654 9987\n
   Registration
                                 RAU 2020\n
SIVE 298701 upload: f1.txt
                               User: sigma01.ist.utl.pt
                                                                TCP
                                 $./User -n sigma03 -p 58000
                                                                    UPL 12345 2020 f1.txt 6 Hello!\n
                                         -m sigma04 -q 59000
      user checks when the
                                 > login 12345 password
      validation code (VC) is
                                    You are now logged in.
      received in the PD
                                  > req U f1.txt
                                  > val 9987
                                    Authenticated! (TID=2020)
                                  > upload f1.txt
```

PD, User, AS, FS

```
AS: sigma03.ist.utl.pt
                    UD
                                  $ ./AS -p 58000 -v
                                   PD: new user, UID=12345
REG 12345 password sigma02 57000\n
                                   User: login ok, UID=12345
RRG OK\n
                                   User: upload req, UID=12345
VLC 12345 9987 U f1.txt\n
                                         file: f1.txt, RID=7654
RVC OK\n
                                         VC=9987
                                  User: UID=12345
                                         U, f1.txt, TID=2020
                                                                 UD
                                                                  P FS: sigma04.ist.utl.pt
PD: sigma02.ist.utl.pt
                                 LOG 12345 password\n
                                                                      $ ./FS -a 59000
 $./PD sigma02 -d 57000
                           \mathsf{TCP}
                                 RLO OK\n
                                                                             -n sigma03 -p 58000 -v
   -n sigma03 -p 58000
                                 REO 12345 7654 U f1.txt\n
                                                                     UID=12345: upload f1.txt (6 Bytes)
> reg 12345 password
                                 RRQ OK\n
                                 AUT 12345 7654 9987\n
   Registration
                                 RAU 2020\n
SIVE 298701 upload: f1.txt
                               User: sigma01.ist.utl.pt
                                                                TCP
                                 $./User -n sigma03 -p 58000
                                                                    UPL 12345 2020 f1.txt 6 Hello!\n
                                         -m sigma04 -q 59000
      user checks when the
                                 > login 12345 password
      validation code (VC) is
                                    You are now logged in.
      received in the PD
                                  > req U f1.txt
                                  > val 9987
                                    Authenticated! (TID=2020)
                                  > upload f1.txt
```

PD, User, AS, FS

```
AS: sigma03.ist.utl.pt
                    UD
                                  $ ./AS -p 58000 -v
                                   PD: new user, UID=12345
REG 12345 password sigma02 57000\n
                                   User: login ok, UID=12345
RRG OK\n
                                   User: upload req, UID=12345
VLC 12345 9987 U f1.txt\n
                                         file: f1.txt, RID=7654
RVC OK\n
                                                                   VLD 12345 2020\n
                                         VC=9987
                                  User: UID=12345
                                         U, f1.txt, TID=2020
                                                                  UD
                                                                  P FS: sigma04.ist.utl.pt
PD: sigma02.ist.utl.pt
                                 LOG 12345 password\n
                                                                      $ ./FS -a 59000
 $./PD sigma02 -d 57000
                           \mathsf{TCP}
                                 RLO OK\n
                                                                             -n sigma03 -p 58000 -v
    -n sigma03 -p 58000
                                 REO 12345 7654 U f1.txt\n
                                                                     UID=12345: upload f1.txt (6 Bytes)
> reg 12345 password
                                 RRQ OK\n
                                 AUT 12345 7654 9987\n
   Registration
                                 RAU 2020\n
SIVE 298701 upload: f1.txt
                               User: sigma01.ist.utl.pt
                                                                TCP
                                 $./User -n sigma03 -p 58000
                                                                    UPL 12345 2020 f1.txt 6 Hello!\n
                                         -m sigma04 -q 59000
      user checks when the
                                 > login 12345 password
      validation code (VC) is
                                    You are now logged in.
      received in the PD
                                  > req U f1.txt
                                 > val 9987
                                    Authenticated! (TID=2020)
                                  > upload f1.txt
```

PD, User, AS, FS

```
AS: sigma03.ist.utl.pt
                    UD
                                  $ ./AS -p 58000 -v
                                   PD: new user, UID=12345
REG 12345 password sigma02 57000\n
                                   User: login ok, UID=12345
RRG OK\n
                                   User: upload req, UID=12345
VLC 12345 9987 U f1.txt\n
                                         file: f1.txt, RID=7654
RVC OK\n
                                                                   VLD 12345 2020\n
                                         VC=9987
                                   User: UID=12345
                                         U, f1.txt, TID=2020
                                   FS: validated for UID=12345-
                                                                  UD
                                         U, f1.txt
                                                                  P FS: sigma04.ist.utl.pt
PD: sigma02.ist.utl.pt
                                 LOG 12345 password\n
                                                                      $ ./FS -a 59000
 $./PD sigma02 -d 57000
                           \mathsf{TCP}
                                 RLO OK\n
                                                                             -n sigma03 -p 58000 -v
   -n sigma03 -p 58000
                                 REQ 12345 7654 U f1.txt\n
                                                                     UID=12345: upload f1.txt (6 Bytes)
> reg 12345 password
                                 RRQ OK\n
                                 AUT 12345 7654 9987\n
   Registration
                                 RAU 2020\n
SIVE 298701 upload: f1.txt
                               User: sigma01.ist.utl.pt
                                                                TCP
                                 $./User -n sigma03 -p 58000
                                                                    UPL 12345 2020 f1.txt 6 Hello!\n
                                         -m sigma04 -q 59000
      user checks when the
                                 > login 12345 password
      validation code (VC) is
                                    You are now logged in.
      received in the PD
                                  > req U f1.txt
                                 > val 9987
                                    Authenticated! (TID=2020)
                                  > upload f1.txt
```

PD, User, AS, FS

```
AS: sigma03.ist.utl.pt
                    UD
                                  $ ./AS -p 58000 -v
                                   PD: new user, UID=12345
REG 12345 password sigma02 57000\n
                                   User: login ok, UID=12345
RRG OK\n
                                   User: upload req, UID=12345
VLC 12345 9987 U f1.txt\n
                                         file: f1.txt, RID=7654
RVC OK\n
                                                                   VLD 12345 2020\n
                                         VC=9987
                                                                   CNF 12345 2020 U f1.txt\n
                                  User: UID=12345
                                         U, f1.txt, TID=2020
                                  FS: validated for UID=12345-
                                                                  UD
                                         U, f1.txt
                                                                  P FS: sigma04.ist.utl.pt
PD: sigma02.ist.utl.pt
                                 LOG 12345 password\n
                                                                      $ ./FS -a 59000
 $./PD sigma02 -d 57000
                           \mathsf{TCP}
                                 RLO OK\n
                                                                             -n sigma03 -p 58000 -v
    -n sigma03 -p 58000
                                 REO 12345 7654 U f1.txt\n
                                                                     UID=12345: upload f1.txt (6 Bytes)
> reg 12345 password
                                 RRQ OK\n
                                 AUT 12345 7654 9987\n
   Registration
                                 RAU 2020\n
SIVE-298FUI upload: f1.txt
                               User: sigma01.ist.utl.pt
                                                                TCP
                                 $./User -n sigma03 -p 58000
                                                                    UPL 12345 2020 f1.txt 6 Hello!\n
                                         -m sigma04 -q 59000
      user checks when the
                                 > login 12345 password
      validation code (VC) is
                                    You are now logged in.
      received in the PD
                                  > req U f1.txt
                                 > val 9987
                                    Authenticated! (TID=2020)
                                  > upload f1.txt
```

PD, User, AS, FS

```
AS: sigma03.ist.utl.pt
                    UD
                                  $ ./AS -p 58000 -v
                                   PD: new user, UID=12345
REG 12345 password sigma02 57000\n
                                   User: login ok, UID=12345
RRG OK\n
                                   User: upload req, UID=12345
VLC 12345 9987 U f1.txt\n
                                         file: f1.txt, RID=7654
RVC OK\n
                                                                   VLD 12345 2020\n
                                         VC=9987
                                                                   CNF 12345 2020 U f1.txt\n
                                  User: UID=12345
                                         U, f1.txt, TID=2020
                                  FS: validated for UID=12345-
                                                                 UD
                                         U, f1.txt
                                                                  P FS: sigma04.ist.utl.pt
PD: sigma02.ist.utl.pt
                                 LOG 12345 password\n
                                                                     $ ./FS -a 59000
 $./PD sigma02 -d 57000
                           \mathsf{TCP}
                                 RLO OK\n
                                                                             -n sigma03 -p 58000 -v
    -n sigma03 -p 58000
                                 REO 12345 7654 U f1.txt\n
                                                                     UID=12345: upload f1.txt (6 Bytes)
> reg 12345 password
                                 RRQ OK\n
                                                                     operation validated
                                 AUT 12345 7654 9987\n
   Registration
                                 RAU 2020\n
                                                                     f1.txt stored for UID=12345
SIVE 298701 upload: f1.txt
                               User: sigma01.ist.utl.pt
                                                                TCP
                                 $./User -n sigma03 -p 58000
                                                                    UPL 12345 2020 f1.txt 6 Hello!\n
                                         -m sigma04 -q 59000
      user checks when the
                                 > login 12345 password
      validation code (VC) is
                                    You are now logged in.
      received in the PD
                                  > req U f1.txt
                                 > val 9987
                                    Authenticated! (TID=2020)
                                  > upload f1.txt
```

PD, User, AS, FS

```
AS: sigma03.ist.utl.pt
                    UD
                                  $ ./AS -p 58000 -v
                                   PD: new user, UID=12345
REG 12345 password sigma02 57000\n
                                   User: login ok, UID=12345
RRG OK\n
                                   User: upload req, UID=12345
VLC 12345 9987 U f1.txt\n
                                         file: f1.txt, RID=7654
RVC OK\n
                                                                   VLD 12345 2020\n
                                         VC=9987
                                                                   CNF 12345 2020 U f1.txt\n
                                  User: UID=12345
                                         U, f1.txt, TID=2020
                                  FS: validated for UID=12345-
                                                                 UD
                                         U, f1.txt
                                                                  P FS: sigma04.ist.utl.pt
PD: sigma02.ist.utl.pt
                                 LOG 12345 password\n
                                                                      $ ./FS -a 59000
 $./PD sigma02 -d 57000
                           \mathsf{TCP}
                                 RLO OK\n
                                                                             -n sigma03 -p 58000 -v
    -n sigma03 -p 58000
                                 REQ 12345 7654 U f1.txt\n
                                                                     UID=12345: upload f1.txt (6 Bytes)
> reg 12345 password
                                 RRQ OK\n
                                                                     operation validated
                                 AUT 12345 7654 9987\n
   Registration
                                 RAU 2020\n
                                                                     f1.txt stored for UID=12345
SIVE 298701 upload: f1.txt
                               User: sigma01.ist.utl.pt
                                                                TCP
                                 $./User -n sigma03 -p 58000
                                                                    UPL 12345 2020 f1.txt 6 Hello!\n
                                         -m sigma04 -q 59000
                                                                     RUP OK\n
      user checks when the
                                 > login 12345 password
      validation code (VC) is
                                    You are now logged in.
      received in the PD
                                  > req U f1.txt
                                 > val 9987
                                    Authenticated! (TID=2020)
                                  > upload f1.txt
```

PD, User, AS, FS

```
AS: sigma03.ist.utl.pt
                    UD
                                  $ ./AS -p 58000 -v
                                   PD: new user, UID=12345
REG 12345 password sigma02 57000\n
                                   User: login ok, UID=12345
RRG OK\n
                                   User: upload req, UID=12345
VLC 12345 9987 U f1.txt\n
                                         file: f1.txt, RID=7654
RVC OK\n
                                                                   VLD 12345 2020\n
                                         VC=9987
                                                                   CNF 12345 2020 U f1.txt\n
                                  User: UID=12345
                                         U, f1.txt, TID=2020
                                  FS: validated for UID=12345-
                                                                 UD
                                         U, f1.txt
                                                                  P FS: sigma04.ist.utl.pt
PD: sigma02.ist.utl.pt
                                 LOG 12345 password\n
                                                                     $ ./FS -a 59000
 $./PD sigma02 -d 57000
                           \mathsf{TCP}
                                 RLO OK\n
                                                                             -n sigma03 -p 58000 -v
    -n sigma03 -p 58000
                                 REQ 12345 7654 U f1.txt\n
                                                                     UID=12345: upload f1.txt (6 Bytes)
> reg 12345 password
                                 RRQ OK\n
                                                                     operation validated
                                 AUT 12345 7654 9987\n
   Registration
                                 RAU 2020\n
                                                                     f1.txt stored for UID=12345
SIVE 298701 upload: f1.txt
                               User: sigma01.ist.utl.pt
                                                                TCP
                                 $./User -n sigma03 -p 58000
                                                                    UPL 12345 2020 f1.txt 6 Hello!\n
                                         -m sigma04 -q 59000
                                                                     RUP OK\n
      user checks when the
                                 > login 12345 password
      validation code (VC) is
                                    You are now logged in.
      received in the PD
                                  > req U f1.txt
                                 > val 9987
                                    Authenticated! (TID=2020)
                                  > upload f1.txt
                                   success uploading f1.txt
```

PD, User, AS, FS

```
AS: sigma03.ist.utl.pt
                    UD
                                  $ ./AS -p 58000 -v
                                   PD: new user, UID=12345
REG 12345 password sigma02 57000\n
                                   User: login ok, UID=12345
RRG OK\n
                                   User: upload req, UID=12345
VLC 12345 9987 U f1.txt\n
                                         file: f1.txt, RID=7654
RVC OK\n
                                                                   VLD 12345 2020\n
                                         VC=9987
                                                                   CNF 12345 2020 U f1.txt\n
                                  User: UID=12345
                                         U, f1.txt, TID=2020
                                  FS: validated for UID=12345-
                                                                 UD
                                         U, f1.txt
                                                                  P FS: sigma04.ist.utl.pt
PD: sigma02.ist.utl.pt
                                 LOG 12345 password\n
                                                                      $ ./FS -a 59000
 $./PD sigma02 -d 57000
                           \mathsf{TCP}
                                 RLO OK\n
                                                                             -n sigma03 -p 58000 -v
    -n sigma03 -p 58000
                                 REO 12345 7654 U f1.txt\n
                                                                     UID=12345: upload f1.txt (6 Bytes)
> reg 12345 password
                                 RRQ OK\n
                                                                     operation validated
                                 AUT 12345 7654 9987\n
   Registration
                                 RAU 2020\n
                                                                     f1.txt stored for UID=12345
SIVE-298FUI upload: f1.txt
                               User: sigma01.ist.utl.pt
                                                                TCP
                                 $./User -n sigma03 -p 58000
                                                                    UPL 12345 2020 f1.txt 6 Hello!\n
                                         -m sigma04 -q 59000
                                                                     RUP OK\n
      user checks when the
                                 > login 12345 password
      validation code (VC) is
                                    You are now logged in.
      received in the PD
                                  > req U f1.txt
                                 > val 9987
                                    Authenticated! (TID=2020)
                                  > upload f1.txt
                                   success uploading f1.txt
                                 > exit
```

| <i>PD</i> command | PD – AS (UDP) |
|-------------------|------------------|
| reg UID pass | REG→ ←RRG |
| exit | UNR→ ←RUN |

| User command | User – AS (TCP) | AS – PD (UDP) | User – FS (TCP) | AS – FS (UDP) |
|------------------------------------|------------------------|------------------|--------------------|------------------|
| login UID pass | LOG→ ←RLO | | | |
| req Fop [Fname] | REQ→ ←RRQ | VLC→ ←RVC | | |
| val VC | AUT→ ←RAU | | | |
| list l | | | LST→ ←RLS | VLD→ ←CNF |
| retrieve filename r filename | | | RTV→ ←RRT | VLD→ ←CNF |
| upload filename u filename | | | UPL→ ←RUP | VLD→ ←CNF |
| delete filename d filename | | | DEL→ ←RDL | VLD→ ←CNF |
| remove X | | | REM→ ←RRM | VLD→ ←CNF |
| exit | (close TCP connection) | | | |

RC two factor authentication

O código desenvolvido em C ou C++ deve funcionar no cluster **sigma** e estar convenientemente **estruturado** e **comentado**.

As chamadas de sistema *read()* e *write()* podem ler e escrever, respetivamente, um numero de bytes inferior ao que lhes foi solicitado – deve garantir que ainda assim a sua implementação funciona corretamente.

Os processos (clientes e servidores) devem terminar graciosamente pelo menos nas seguintes situações de falha:

- mensagens do protocolo erradas vindas da entidade par correspondente;
- condições de erro das chamadas de sistema

O código a entregar: ficheiros fonte dos programas (*User*, *PD*, *AS*, *FS*), *Makefile*, *e ficheiros auxiliares*.

Entrega <u>por e-mail</u>, **até dia 13 de Novembro de 2020, às 23h59mn**.

Deve criar um único ficheiro de arquivo **zip** com todos os ficheiros fonte e outros ficheiros necessários à execução das aplicações. O arquivo deve estar preparado para ser aberto para o diretório corrente e compilado com o comando make. O nome do ficheiro submetido deve ter o seguinte formato: **proj<número do**