

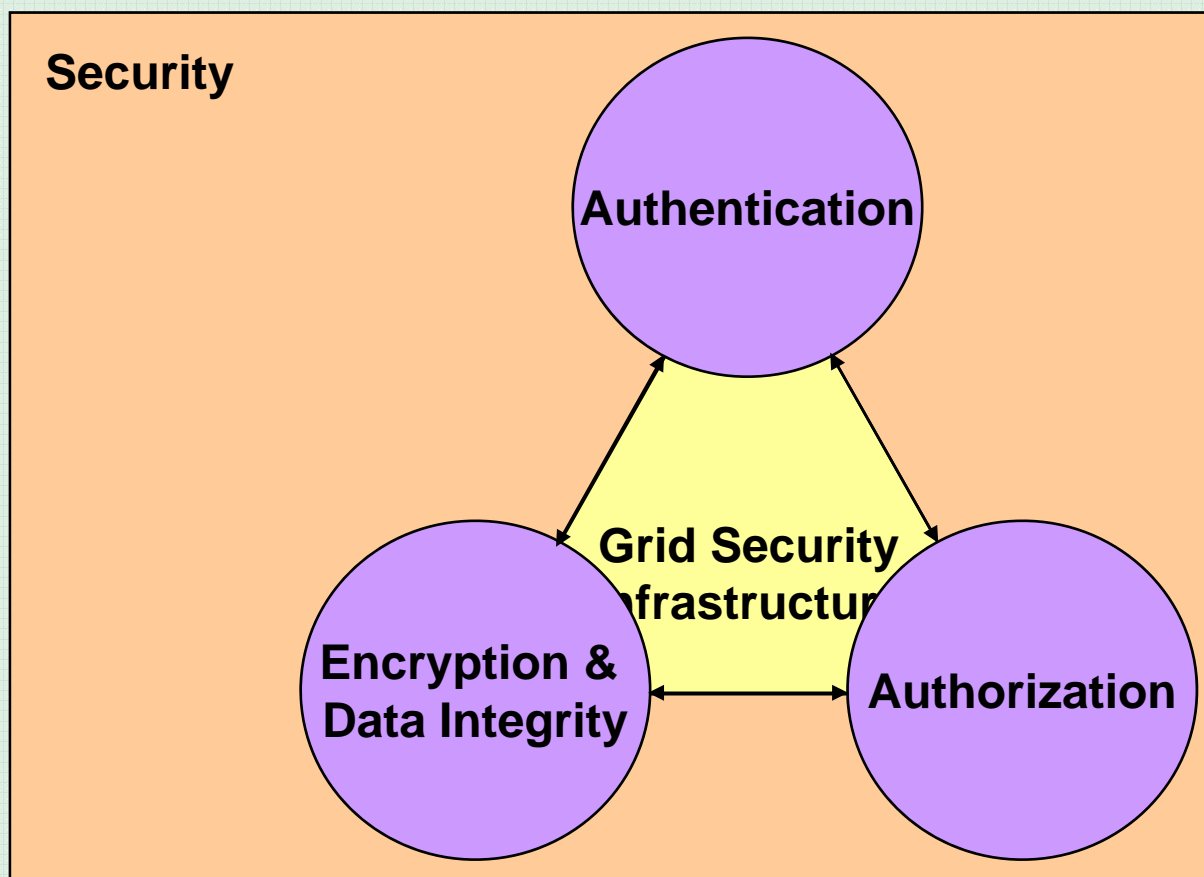
Security, Authorisation and Authentication

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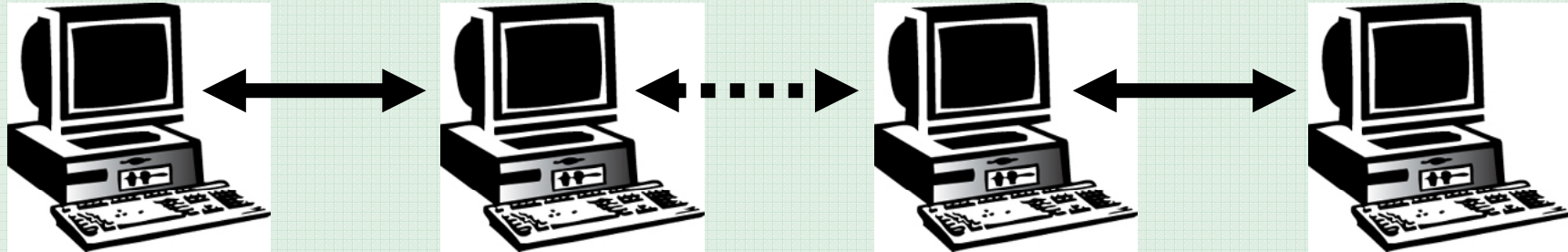
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- However if you do so then please let training-support@nesc.ac.uk know. We need to gather statistics of re-use: no. of events, number of people trained. Thank you!!

Security Overview



The Problems - 1



User

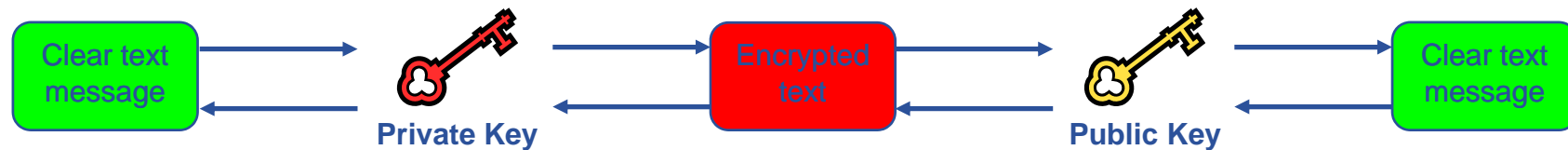
Resource

- How does a user securely access the Resource without having an account on the machines in between or even on the Resource?
- How does the Resource know who a user is?
- How are rights and that they are allowed access?

The Problems -2: Reducing vulnerability

- Launch attacks to other sites
 - Large distributed farms of machines, perfect for launching a Distributed Denial of Service attack.
- Illegal or inappropriate data distribution and access sensitive information
 - Massive distributed storage capacity ideal for example, for swapping movies.
- Damage caused by viruses, worms etc.
 - Highly connected infrastructure means worms spread faster than on the internet in general.

- Asymmetric encryption...



- and Digital signatures ...

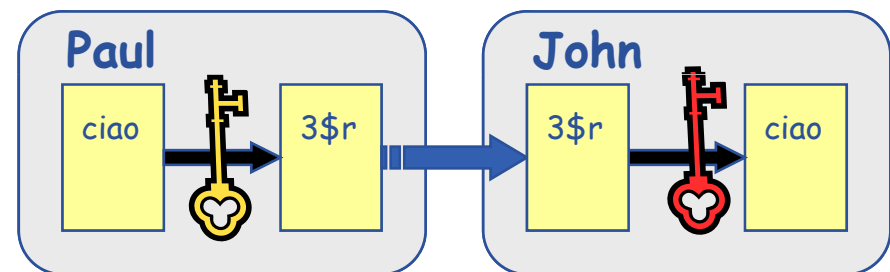
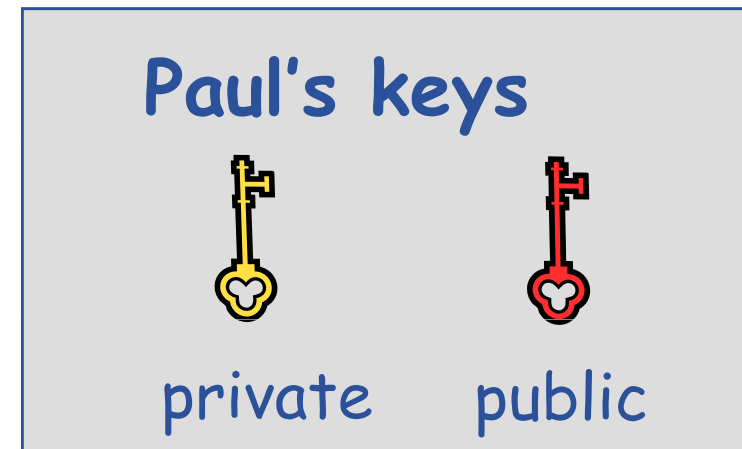
- A hash derived from the message and encrypted with the signer's private key
- Signature is checked by decrypting with the signer's public key

- Are used to build trust

- That a user / site is who they say they are
- And can be trusted to act in accord with agreed policies

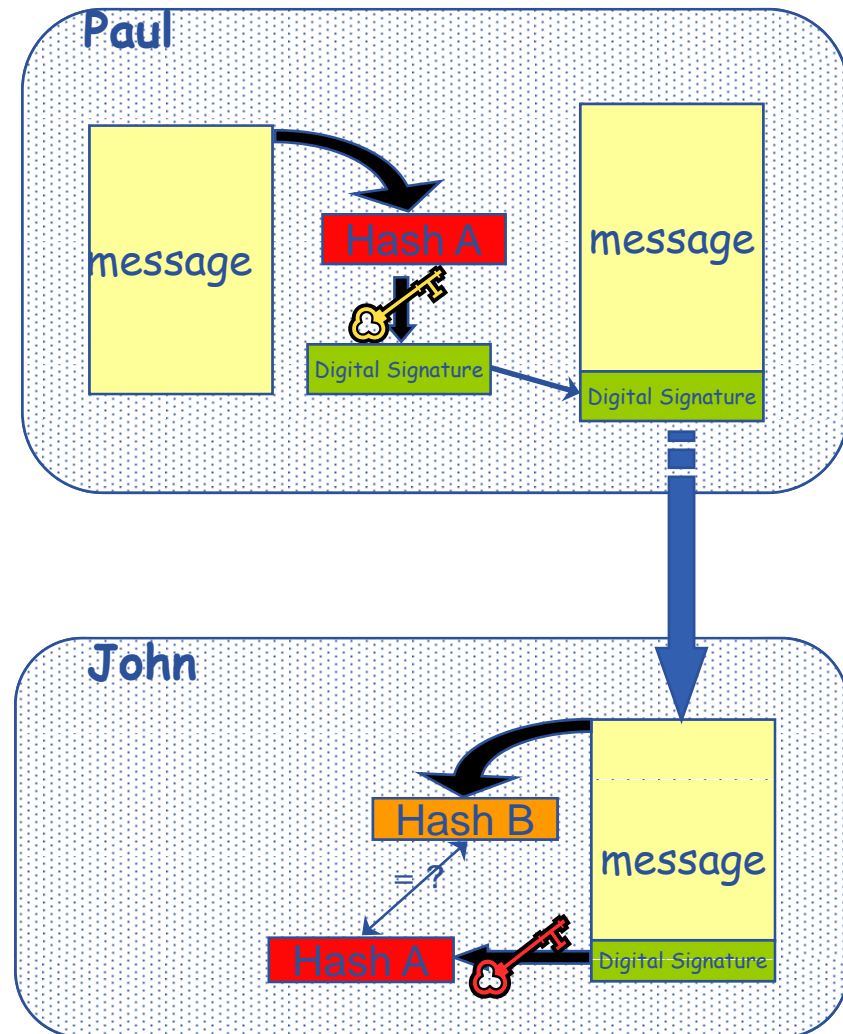
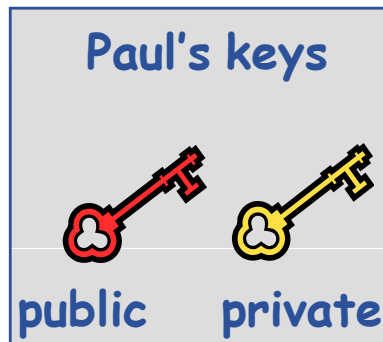
Public Key Algorithms

- Every user has two keys: one *private* and one *public*:
 - it is *impossible* to derive the private key from the public one;
 - a message encrypted by one key can be decrypted **only** by the other one.
- Public keys are exchanged
- The sender encrypts using his private key
- The receiver decrypts using senders public key;
- The number of keys is $O(n)$



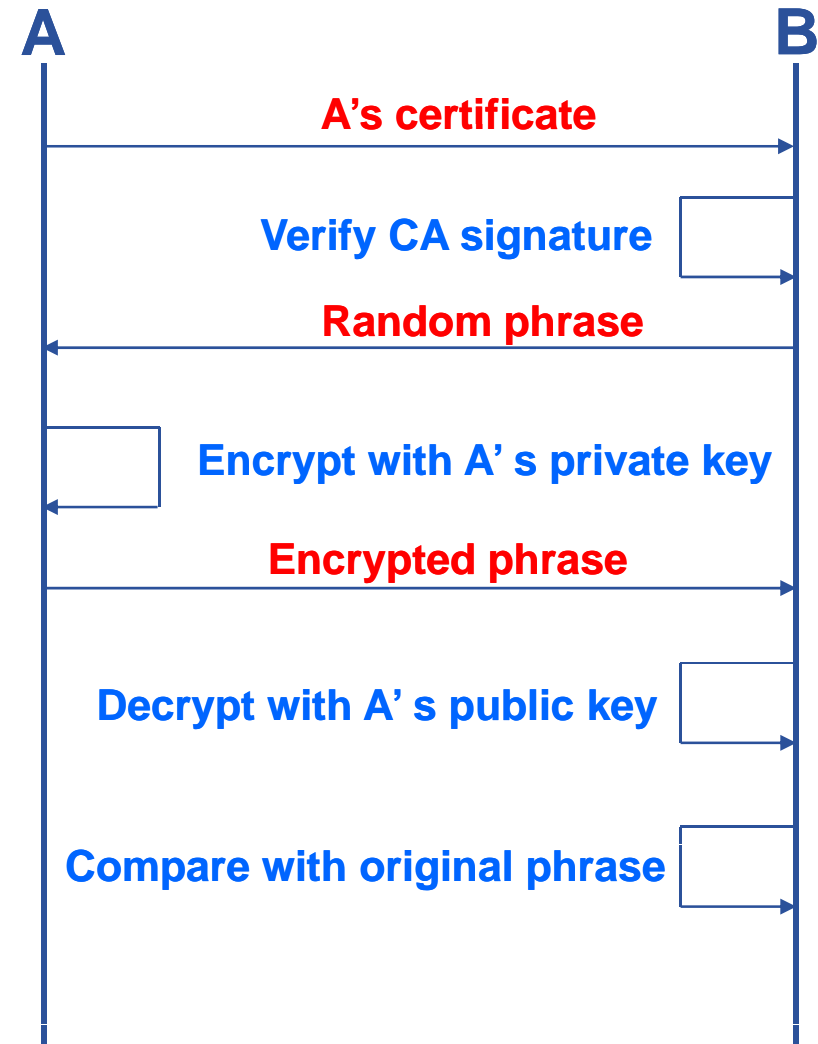
Digital Signature

- Paul calculates the *hash* of the message
- Paul encrypts the hash using his *private* key: the encrypted hash is the *digital signature*.
- Paul sends the signed message to John.
- John calculates the hash of the message
- Decrypts signature, to get A, using Paul's *public* key.
- If hashes equal:
 1. message wasn't modified;
 2. hash A is from Paul's private key



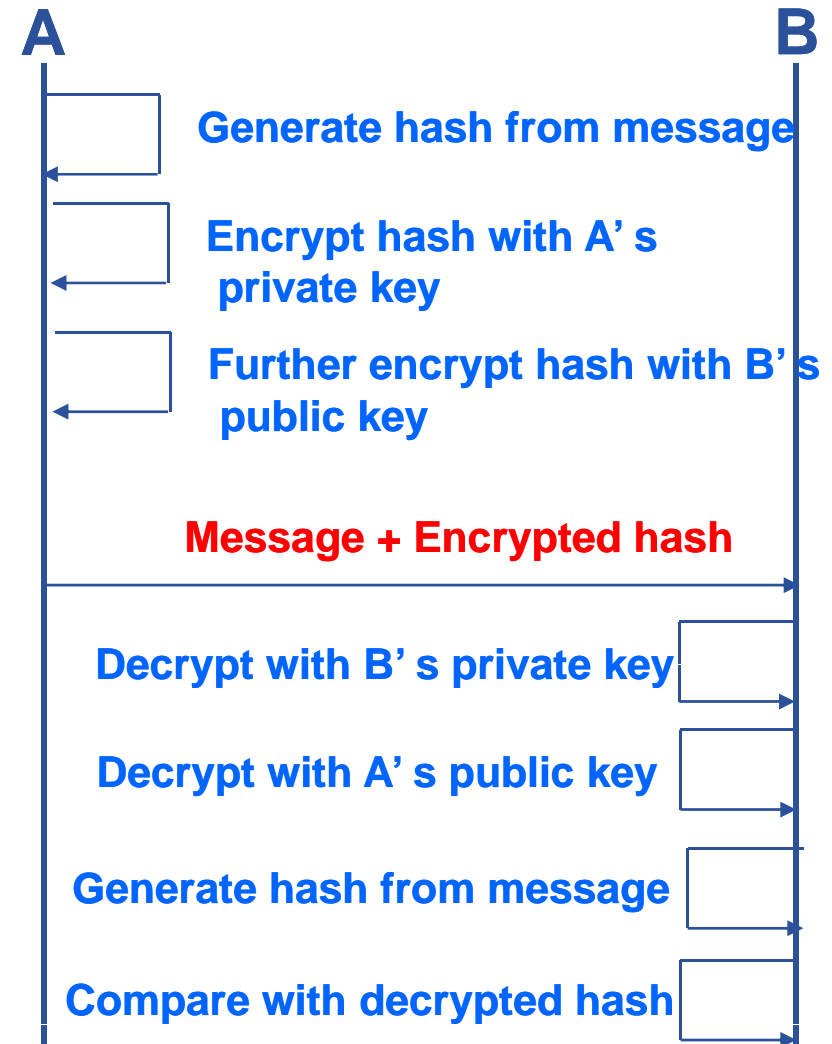
Based on X.509 PKI:

- every Grid transaction is mutually authenticated:
 1. A sends his certificate;
 2. B verifies signature in A's certificate using CA public certificate;
 3. B sends to A a challenge string;
 4. A encrypts the challenge string with his private key;
 5. A sends encrypted challenge to B
 6. B uses A's public key to decrypt the challenge.
 7. B compares the decrypted string with the original challenge
 8. If they match, B verified A's identity and A can not repudiate it.
 9. Repeat for A to verify B's identity



After A and B authenticated each other,
for A to send a message to B:

- **Default: message integrity checking**
 - Not private – a test for tampering
- **For private communication:**
 - Encrypt all the message (not just hash) - Slower



- How can John be sure that Paul's public key is really Paul's public key and not someone else's?
 - A *third party* certifies correspondence between the public key and Paul's identity.
 - Both John and Paul trust this third party

The “third party” is called a Certification Authority (CA).

- **An X.509 Certificate contains:**

- owner's public key; →

- identity of the owner; →

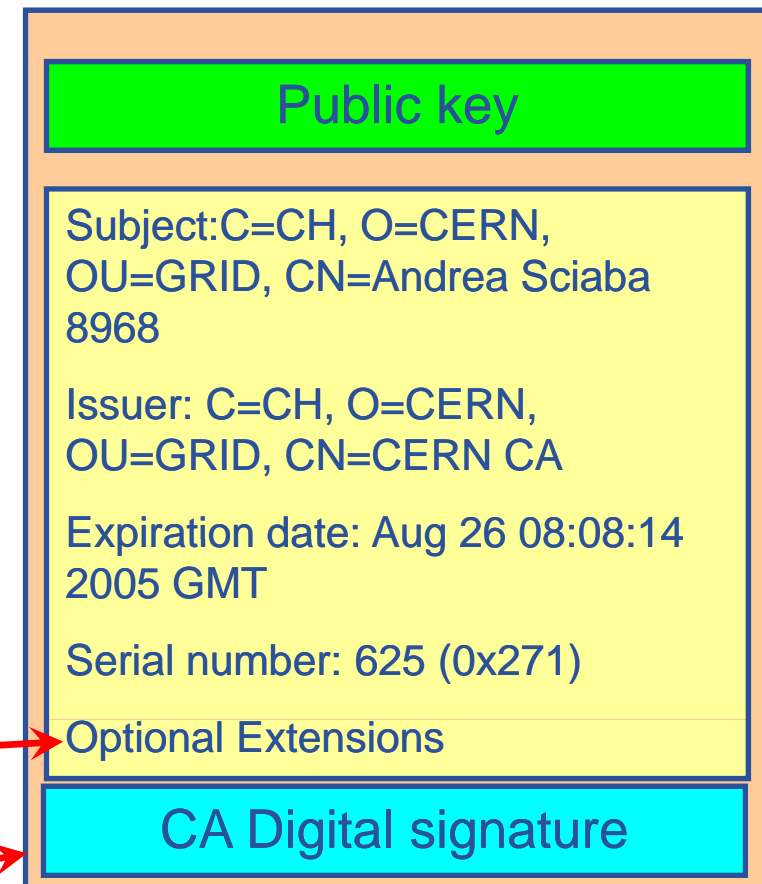
- info on the CA; →

- time of validity; →

- Serial number; →

- Optional extensions →

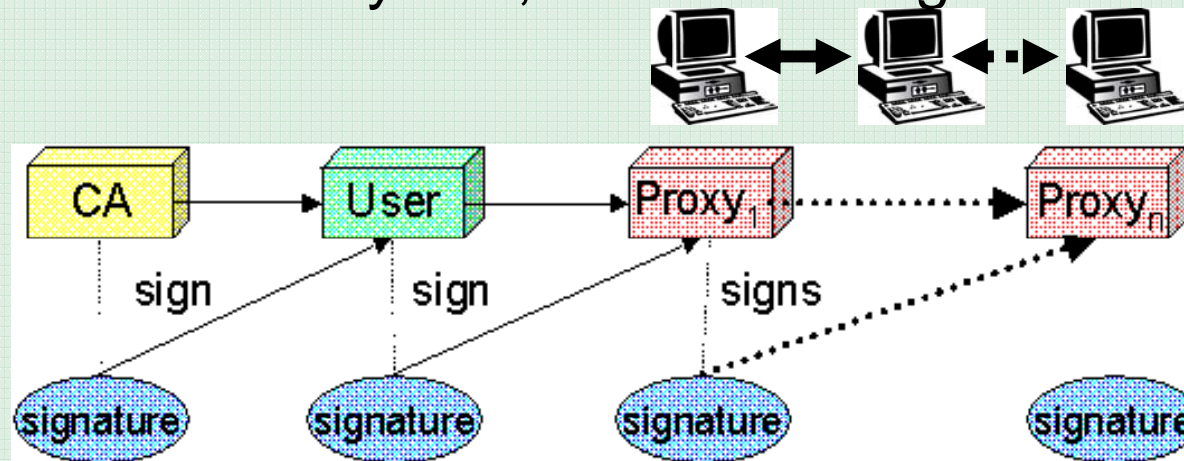
- digital signature of the CA →



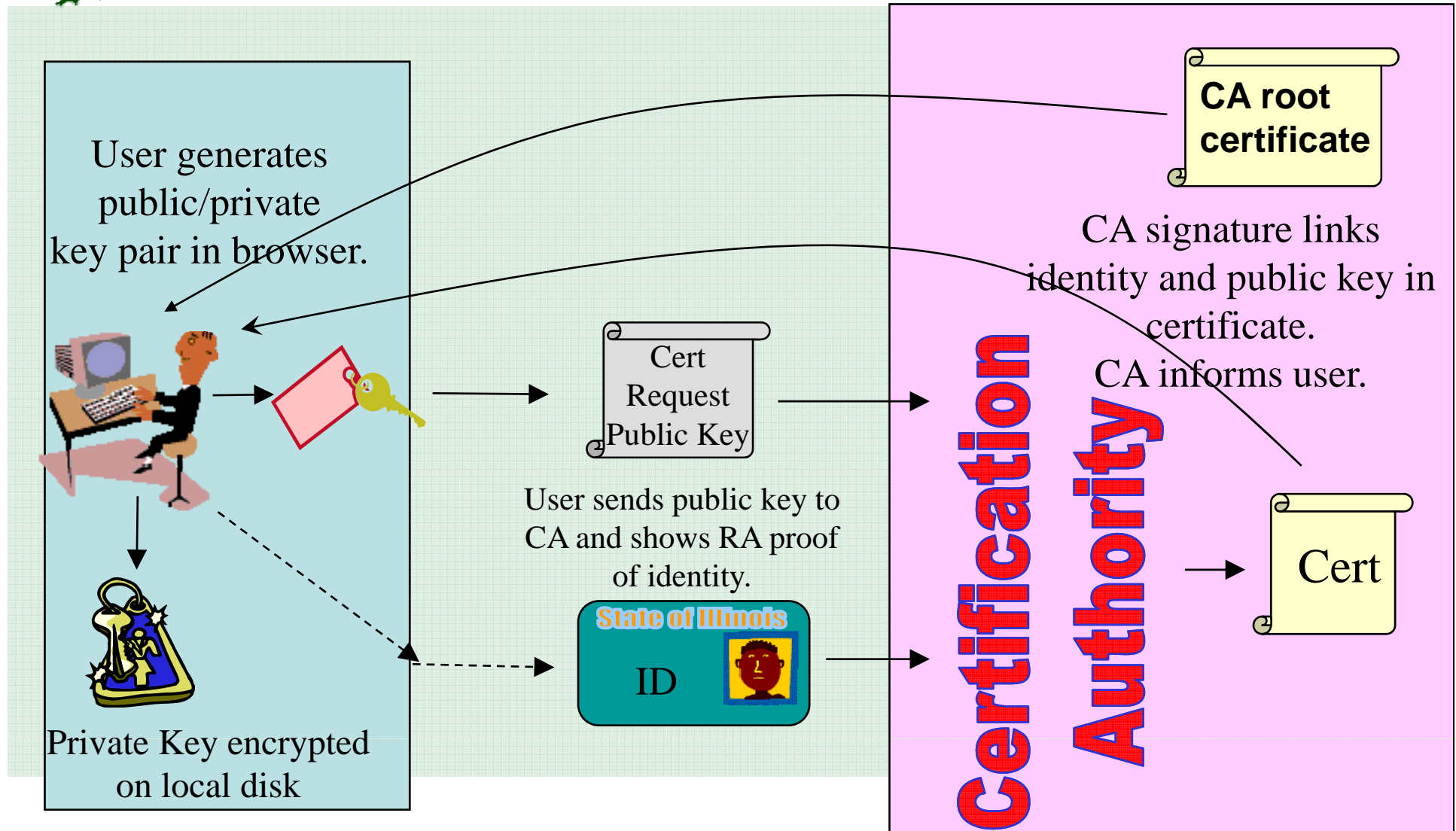
- User's identity has to be certified by one of the national *Certification Authorities* (CAs)
- Resources are also certified by CAs
- CAs are mutually recognized
<http://www.gridpma.org/>,
- CAs each establish a number of people “registration authorities” RAs
- To find RAs in UK go to <http://www.grid-support.ac.uk/ca/ralist.htm>

Grid Security Infrastructure - proxies

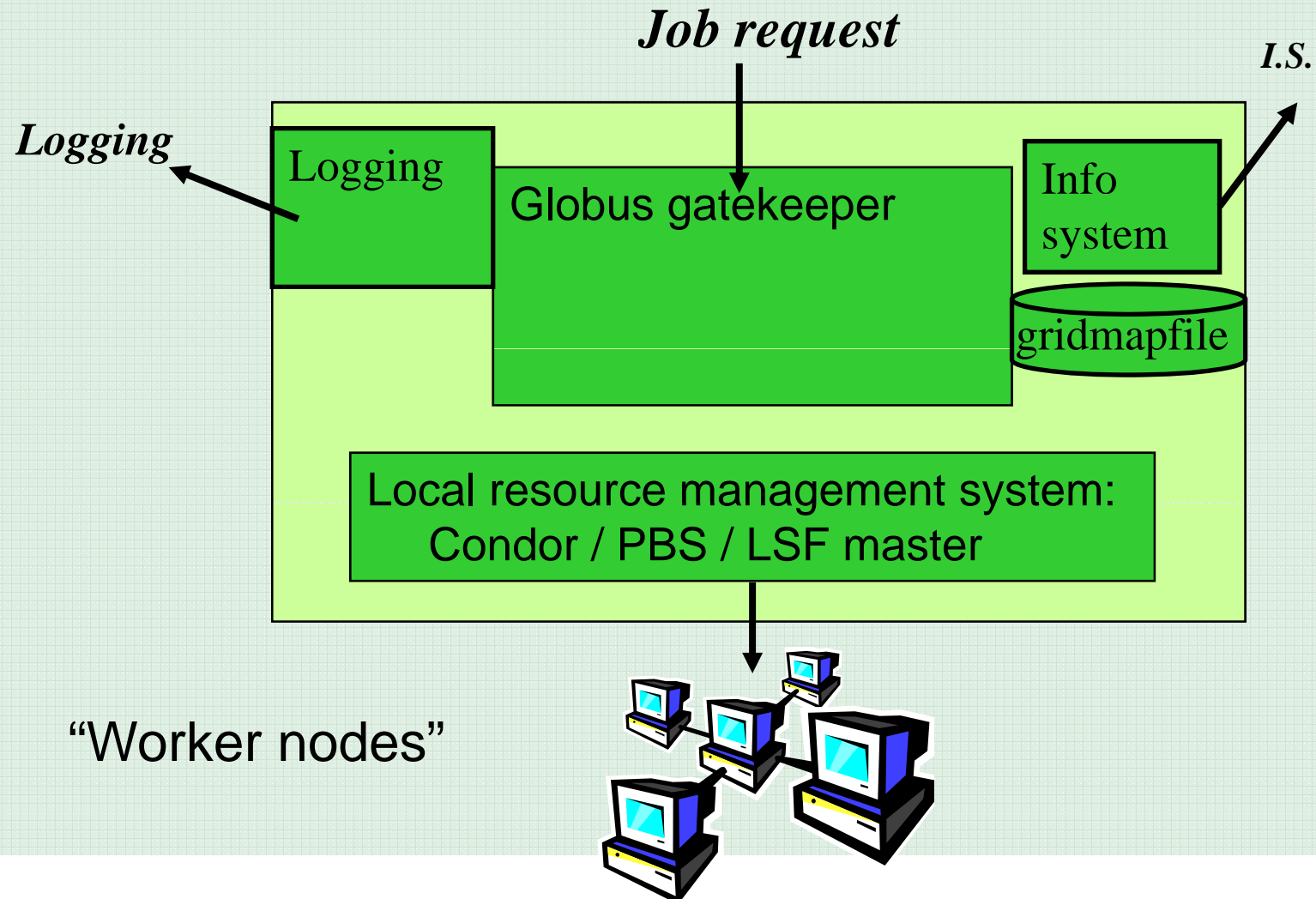
- To support delegation: A delegates to B the right to act on behalf of A
- proxy certificates extend X.509 certificates
 - Short-lived certificates signed by the user's certificate or a proxy
 - Reduces security risk, enables delegation



Certificate Request



“Compute element”: An LRMS queue



User Responsibilities

- Keep your private key secure – *on USB drive only*
- Do not loan your certificate to anyone.
- Report to your local/regional contact if your certificate has been compromised.
- Do not launch a delegation service for longer than your current task needs.

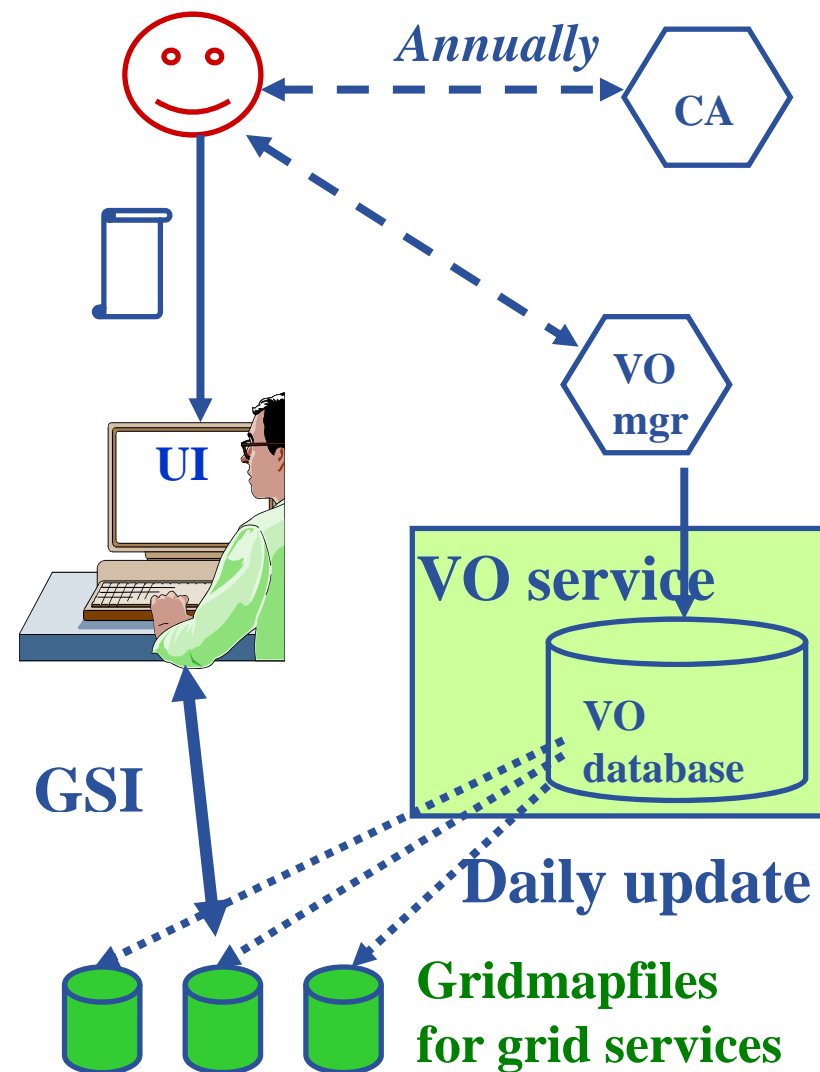
If your certificate or delegated service is used by someone other than you, it cannot be proven that it was not you.

• Authentication

- User obtains certificate from Certificate Authority
- Connects to UI by `gsssh (/ssh)`
UI is the user's interface to Grid
- (Uploads certificate to UI)
- (Single logon – to UI - create proxy)
- then **Grid Security Infrastructure uses proxies**

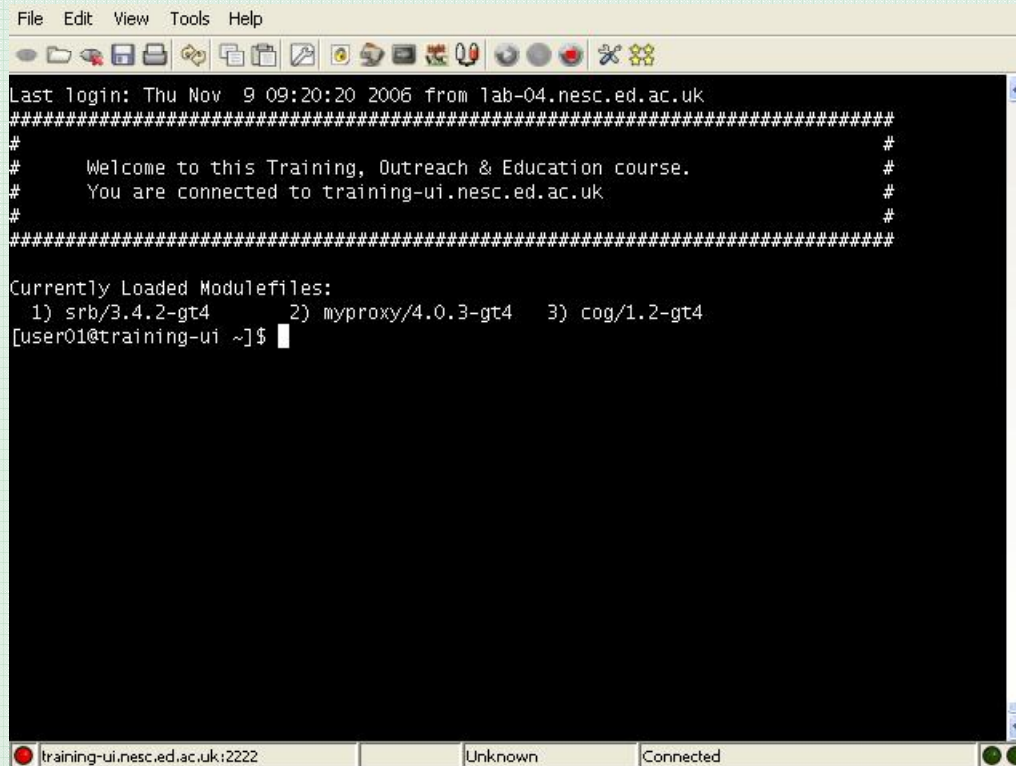
• Authorisation

- User joins Virtual Organisation
- VO negotiates access to Grid nodes and resources
- Authorisation tested by resource:
Gridmapfile (or similar) maps user to local account



Connecting to Resources

Java gsissh



```
File Edit View Tools Help
Last login: Thu Nov  9 09:20:20 2006 from lab-04.nesc.ed.ac.uk
#####
#
#   Welcome to this Training, Outreach & Education course.
#   You are connected to training-ui.nesc.ed.ac.uk
#
#####
Currently Loaded Modulefiles:
  1) srb/3.4.2-gt4      2) myproxy/4.0.3-gt4  3) cog/1.2-gt4
[user01@training-ui ~]$
```

- Java ssh tool modified by NGS to include GSI authentication
- Now a sourceforge project
- Run by java web start, as an applet or standalone



The Training Certificate Authority

- A fully functional certificate authority for issuing low-assurance certificates
- Low-assurance allows:
 - Certificates issued to local organiser and not the attendee.
 - Attendees do not need to sign UK Terms and conditions of use.
 - Identity checks on attendees are not needed.
- No need for the attendee to do anything pre-event.
- All certificate Distinguished Names (DN's) are known pre-event.
- DN's are of the form
“/C=UK//O=Grid/O=Training/CU=NeSC/CN=UserXX” where XX is a two digit number

Certificate Manager (1)



<https://training-ui.nesc.ed.ac.uk>

Certificate Manager (2)

- This tool is designed to be similar to method used by UK CA to distribute certificates
- Distributes your individual/group training certificate
- Tool maps your certificate to your IP Address

Tutorial Step 1

- Go to <https://training-ui.nesc.ed.ac.uk>
- Click Download
- Save file to “My Documents”
 - Note this means you must use the same workstation tomorrow.
- Launch gsissh from desktop shortcut.

Tutorial Step 2

In java gsissh:

- File then New Connection
- Connect to “training-ui.nesc.ed.ac.uk”

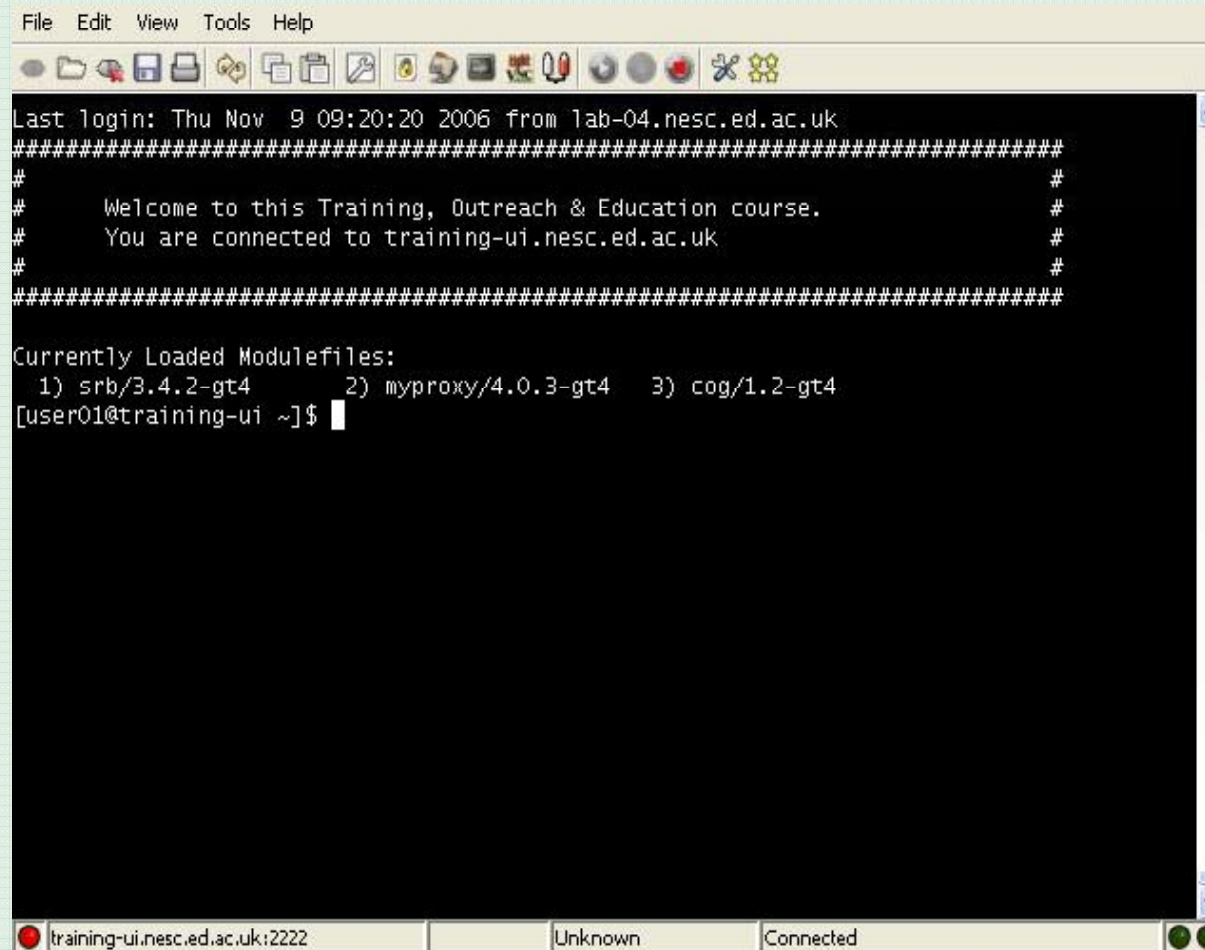


1. Browse to where you saved your certificate (in “My Documents”)

2. Passphrase is “aspdaf”

3. Click “Use Certificate”

Tutorial Finished



```
File Edit View Tools Help
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#
#####

Currently Loaded Modulefiles:
 1) srb/3.4.2-gt4      2) myproxy/4.0.3-gt4  3) cog/1.2-gt4
[user01@training-ui ~]$
```

training-ui.nesc.ed.ac.uk:2222 Unknown Connected