Authentication & Authorization

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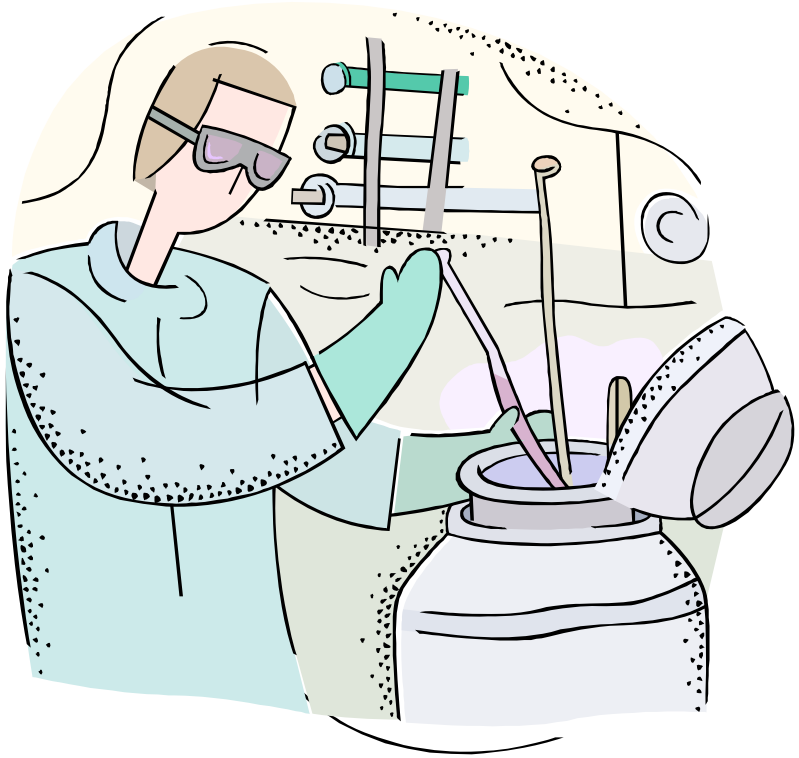
Information Society

Overview

- Basic security concepts
- Certificates & Proxies – Authentication
- Virtual Organisations - Authorization

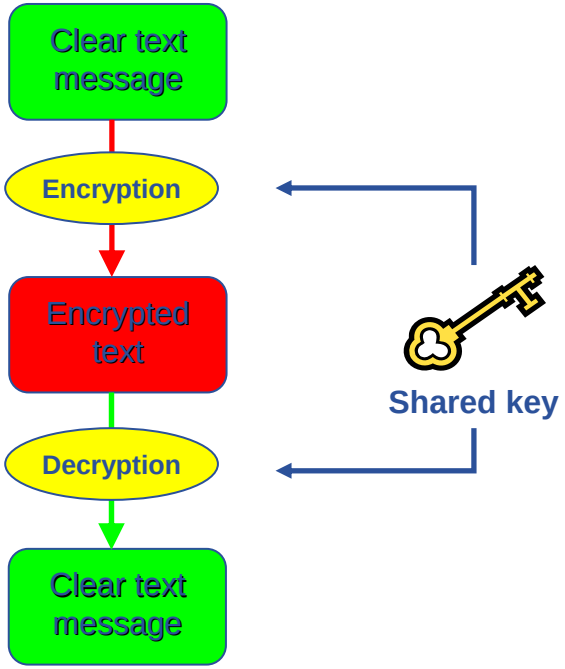


Basic security concepts

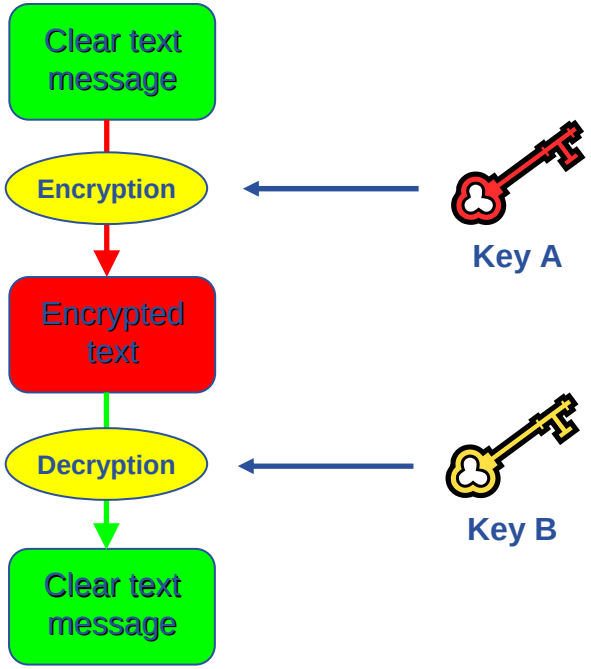
- Authentication
  - Verify the identity of the peer
- Authorization
  - Map an entity to some set of privileges
- Confidentiality
  - Encrypt the message so that only the recipient can understand it
- Integrity
  - Ensure that the message has not be altered in the transmission
- Non-repudiation
  - Impossibility of denying the authenticity of a digital signature
- Accounting
  - What did you do, when did you do it and where did you do it from?

Encryption

- **Symmetric encryption: same key (“secret”) used for encryption and decryption**
  - Kerberos, DES / 3DES, IDEA



- **Asymmetric encryption: different keys used for encryption and decryption**
  - RSA, DSA



Using Asymmetric Keys

- **Sending a message**
  - Encrypt message using Receiver's public key
  - Send encrypted message
  - Receiver decrypts message using own private key

  Only someone with Receiver's private key can decrypt message

- **Authenticating**
  - Encrypt message with Sender's private key
  - Send encrypted message
  - Message is readable by ANYONE with Sender's public key
  - Receiver decrypts message with Sender's public key

  Receiver can be confident that only someone with Sender's private key could have sent the message

Digital Certificates

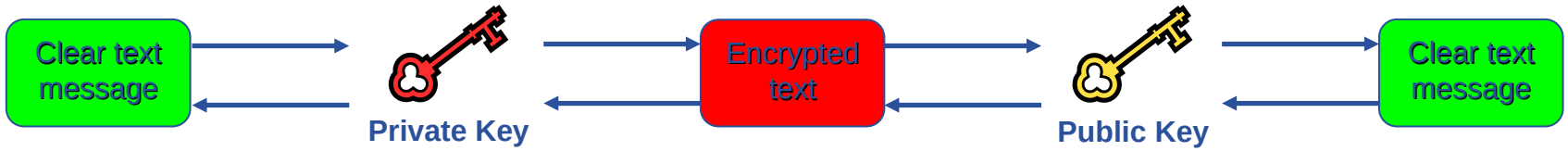
- **Digital signatures**
  - A hash derived from the message and encrypted with the signer's private key
  - Signature checked decrypting with the signer's public key
- **A's digital signature is safe if:**
  1. A's private key is not compromised
  2. B knows A's public key
- **How can B be sure that A's public key is really A's public key and not someone else's?**
  - A *third party* guarantees the correspondence between public key and owner's identity, by signing a document which contains the owner's identity and his public key (**Digital Certificate**)
  - Both A and B must trust this third party
- **Two models:**
  - X.509: hierarchical organization;
  - PGP: "web of trust".

Certification Authorities

- **Issue certificates for users, programs and machines**
- **Check the identity and the personal data of the requestor**
  - Registration Authorities (RAs) do the actual validation
- **Manage Certificate Revocation Lists (CRLs)**
  - They contain all the revoked certificates yet to expire
- **CA certificates are self-signed**

Public Key Infrastructure

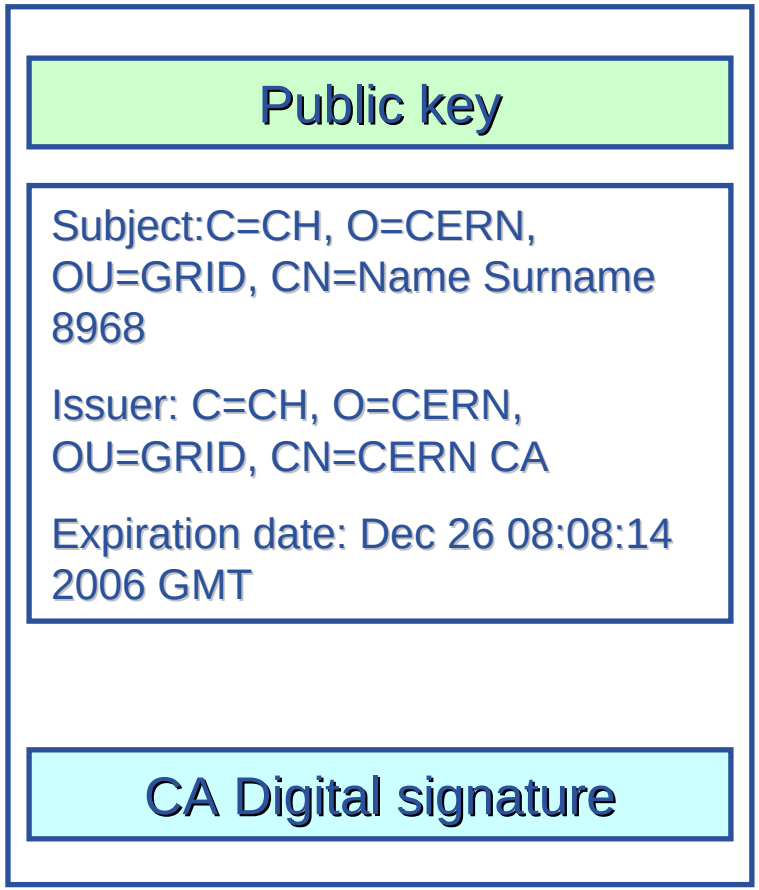
- **Provides authentication, integrity, confidentiality, non-repudiation**
- **Asymmetric encryption**



- **Digital signatures**
  - A hash derived from the message and encrypted with the signer's private key
  - Signature checked decrypting with the signer's public key
- **Allows key exchange in an insecure medium using a trust model**
  - Keys trusted only if signed by a trusted third party (Certification Authority)
  - A CA certifies that a key belongs to a given principal
- **Certificate**
  - Public key + information about the principal + CA signature
  - X.509 format most used
- **PKI used by SSL, PGP, GSI, WS security, S/MIME, etc.**

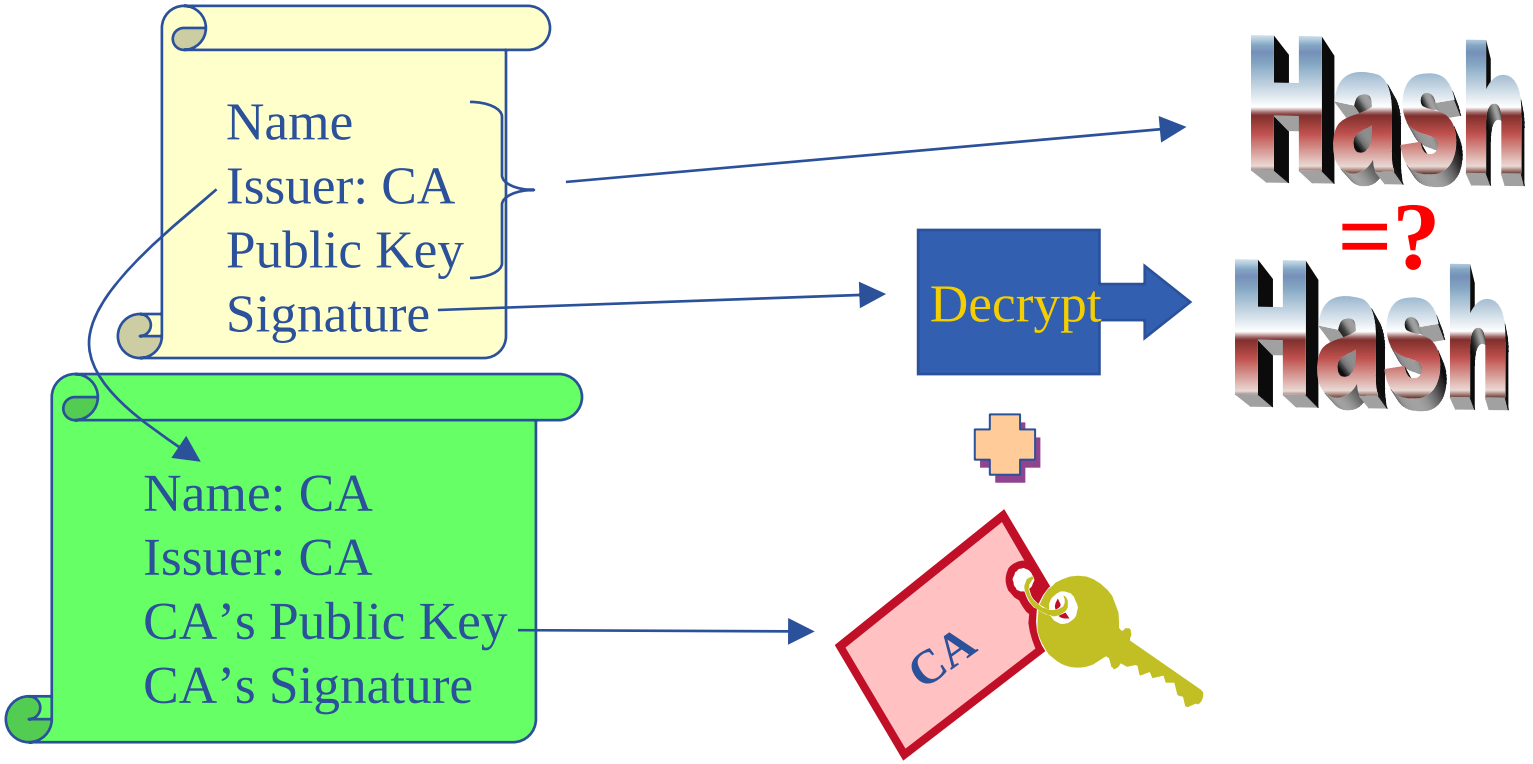
X.509: content of the Certificate

- **An X.509 Certificate contains:**
  - owner's public key;
  - identity of the owner;
  - info on the CA;
  - time of validity;
  - digital signature of the CA



Certificate Validity

- **The public key from the CA certificate can then be used to verify the certificate.**



slide based on presentation given by Carl Kesselman at GGF Summer School 2004

User Responsibilities

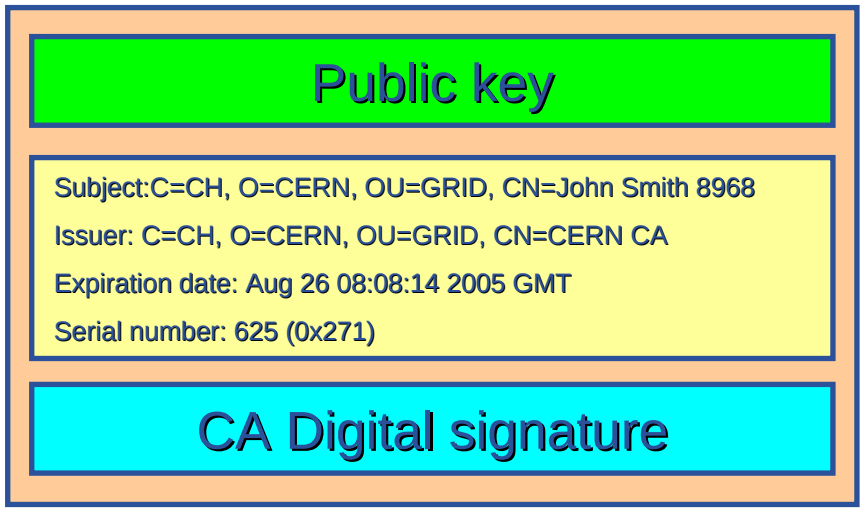
- Keep your private key secure.
- Do not loan your certificate to anyone.
- Report to your local/regional contact if your certificate has been compromised.
- Do not launch a delegation service for longer than your current task needs.

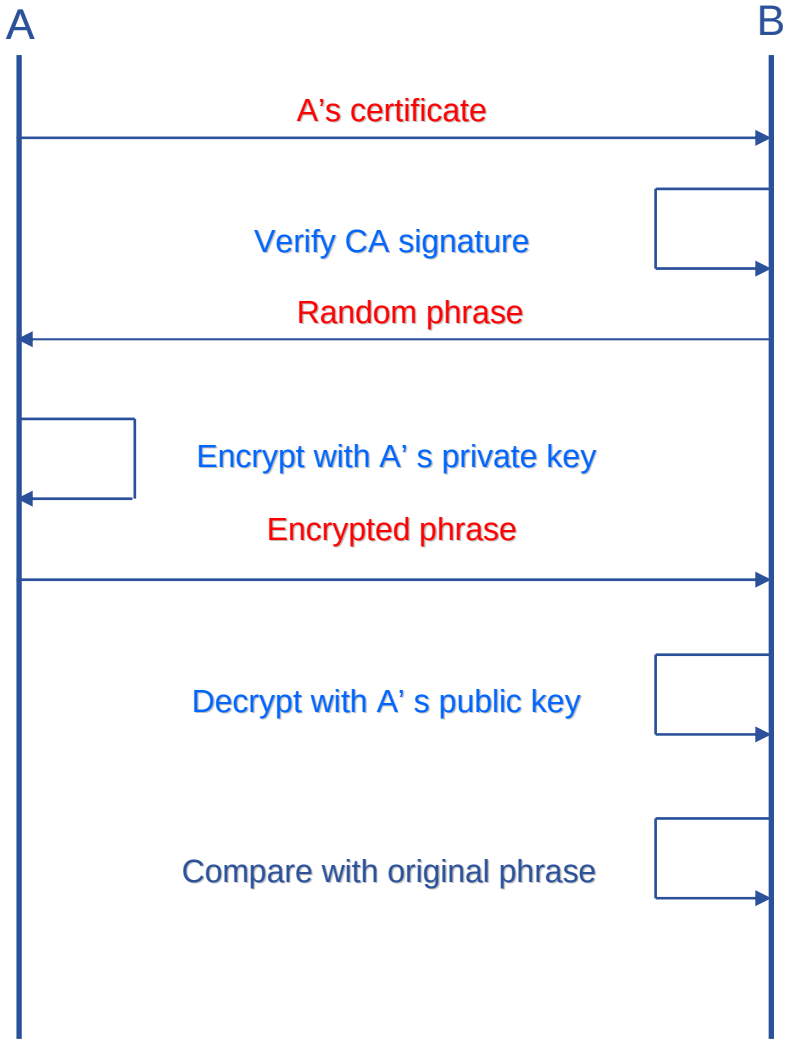
If your certificate or delegated service is used by someone other than you, it cannot be proven that it was not you.

IT IS YOUR PASSPORT AND CREDIT CARD

X.509 certificates and authentication

Structure of a X.509 certificate

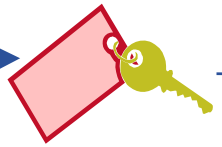




Certificate Request

User generates public/private key pair.

CA confirms identity, signs certificate and sends back to user.



Cert Request Public Key

Private Key encrypted on local disk

User send public key to CA and then appears before RA with TZ/passport.

Certification Authority

Cert

Request a certificate

- Requesting a certificate - https://certificate.iucc.ac.il/
- Receiving the certificate - https://certificate.iucc.ac.il/pub

Please enter your data in the following form.

Certificate Data

E-Mail	my.email@myserver.com
Name	Name LastName
Institution	TAU
alternative email	my.email@myserver.com

User Data

Name (first and Last name)	Name LastName
Email	my.email@myserver.com
Department	My Departement
Telephone	My Telephone
Level Of Assurance chose the LOA you would like to be authenticated against.	Test
Role	User
Registration Authority chose the RA where you will be authenticated.	Tel Aviv University
PIN [used to verify the certification request, min 10 chars (please write it down for later usage)]	•••••••
Re-type your PIN for confirmation	•••••••
Choose a keysize	1024

Continue

LIST of Israeli CA and RAs

- **Eddie Aronovich, Certificate Authority Manager eddiea@tau.ac.il, 03-6406915**
- **Currenlty also performing RA role.**

University	Name	e-mail	phone
Hebrew	Ayelet Hashachar Drori	ayeleth@savion.cc.huji.ac.il	**02-6584475**
Haifa	Herakel Endrawes	herakel@univ.haifa.ac.il	**04-8249249**
Technion	Anne Weill	anne@tx.technion.ac.il	**04-8294997**
Weizmann	Pierre Choukroun	pierre@weizmann.ac.il	**08-9343038**
BGU	Amir Zofnat	zofnat@bgu.ac.il	**08-6479449**
Open-U	Reuven Aviv	aviv@openu.ac.il	**09-7781252**
TAU	Avi Raber	avir@tauex.tau.ac.il	**03-6409117**

X.509: security inside the Grid

- **For the Grid to be an effective framework for largely distributed computation, users, user processes and grid services must work in a secure environment.**

- **The user has to possess a valid X.509 certificate on the submitting machine, consisting of two files:**
  the *certificate file* and the *private key file*.

  - ***"$HOME/.globus/usercert.pem“***
  - ***"$HOME/.globus/userkey.pem"***

X.509: extracting user{cert | key} files

Usually X.509 Certificates are downloaded using a browser and managed by the browser itself.

- Anyway it is possible to export your certificate in a file PKCS12 (which will probably have the extension .p12 or .pfx).
- Unfortunately PKCS12 format is not accepted by Globus security infrastructure, but you can easily convert it into the supported standard (PEM). This operation will split your *.p12 file in two files: the certificate (usercert.pm) and the private key (userkey.pm).
- *With openssl tool:*
- *$ openssl pkcs12 -nocerts -in mycert.p12 -out userkey.pem*
- *$ openssl pkcs12 -clcerts -nokeys -in mycert.p12 -out usercert.pem*
- *$ chmod 0400 userkey.pem*
- *$ chmod 0600 usercert.pem*
- Permission must be set as shown not only for security reasons: *voms-proxy-init* and *grid-proxy-init* commands will fail if your private key is not protected as listed above.

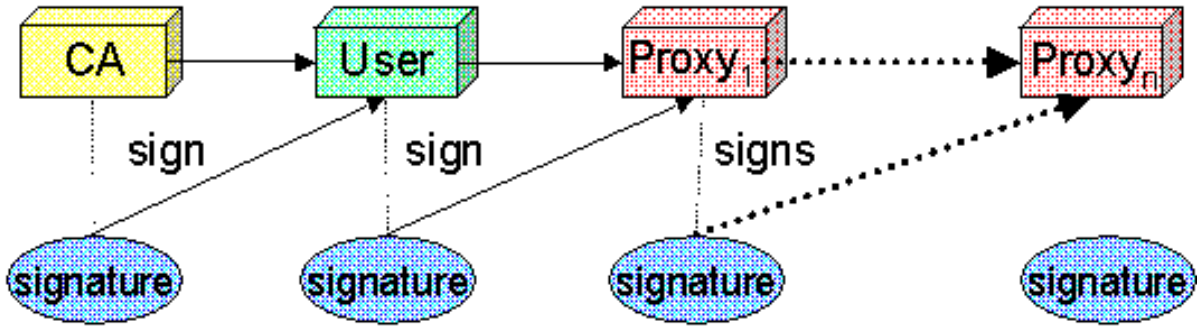
Delegation

Delegation : The act of giving an organisation, person or service the right to act on your behalf.

- **A Site delegates responsibility for the users that may access its resources to the managers/management system.**
- **An organisation delegates its rights to a user.**
- **A user delegates their authentication to a service to allow programs to run on remote sites.**

Globus Grid Security Infrastructure (GSI)

- ***de facto* standard for Grid middleware**
- **Based on PKI**
- **Implements some important features**
  - Single sign-on: no need to give one's password every time
  - Delegation: a service can act on behalf of a person
  - Mutual authentication: both sides must authenticate to the other
- **Introduces proxy certificates**
  - Short-lived certificates including their private key and signed with the user's certificate



X.509: Creating a Proxy Certificate

- Actually the user certificate and private key files are not mandatory on the WMS-UI machine:
  - needed for the creation of the proxy user credentials through *grid-proxy-init* or *voms-proxy-init*
  - downloadability of proxy credentials from a trusted site.

- **All WMS-UI commands, when started, check for the existence and expiration date of user proxy credentials in the location pointed to by *"$X509_USER_PROXY"* or in *"/tmp/x509up_u<UID>"* (where <UID> is the user identifier in the submitting machine OS) if the X509 environment variable is not set.**

- **If the proxy certificate does not exist or has expired the WMS-UI returns an error message to the user and exits.**

- **Notes: Existence of multiple VOs.**

- **A job gets associated a valid proxy certificate (the submitting user's one) when it is submitted by the WMS-UI to NS. Proxy validity default set to 12 hours unless differently specified.**
  - --valid *voms-proxy-init*
  - --hours *grid-proxy-init*
  - features of MyProxy package. Registering a valid long-term certificate proxy that will be used by the WMS to perform a periodic credential renewal for the submitted job.

More on proxy certificates and delegation

- **Delegation**
  - Allowing something else (eg. a file transfer service) to use my credentials
- **Proxies can be moved over a network**
- **Subject identifies the user:**
  - User subject: `/C=CH/O=CERN/OU=GRID/CN=Andrea Sciaba 8968`
  - Proxy subject: `/C=CH/O=CERN/OU=GRID/CN=Andrea Sciaba 8968/CN=proxy`
- **Full proxy**
  - A proxy created from a user certificate or another full proxy with normal delegation
- **Limited proxy**
  - A proxy created from a proxy with limited delegation, or from another limited proxy
- **What does that mean?**
  Entities can decide to accept only full proxies. Examples:
  - GridFTP accepts all proxies
  - Globus gatekeeper accepts only full proxies

GSI environment variables

- **User certificate files:**
  - Certificate: X509_USER_CERT (default: `$HOME/.globus/usercert.pem`)
  - Private key: X509_USER_KEY (default: `$HOME/.globus/userkey.pem`)
  - Proxy: X509_USER_PROXY (default: `/tmp/x509up_u<id>`)
- **Host certificate files:**
  - Certificate: X509_USER_CERT (default: `/etc/grid-security/hostcert.pem`)
  - Private key: X509_USER_KEY (default: `/etc/grid-security/hostkey.pem`)
- **Trusted certification authority certificates:**
  - X509_CERT_DIR (default: `/etc/grid-security/certificates`)
- **Location of the grid-mapfile:**
  - GRIDMAP (default: `/etc/grid-security/grid-mapfile`)

Command line interface: certificate and proxy management

- **Get information on a user certificate**
  - `grid-cert-info[-help] [-file certfile] [OPTION]...`

`-all`	whole certificate
`-subject | -s`	subject string
`-issuer | -I`	Issuer
`-startdate | -sd`	Start of validity
`-enddate | -ed`	End of validity

- **Create a proxy certificate**
  - `grid-proxy-init/voms-proxy-init`
- **Destroy a proxy certificate**
  - `grid-proxy-destroy/voms-proxy-destroy`
- **Get information on a proxy certificate**
  - `grid-proxy-info/voms-proxy-info`

Long term proxy

- **Proxy has limited lifetime (default is 12 h)**
  - Bad idea to have longer proxy
- **However, a grid task might need to use a proxy for a much longer time**
- **myproxy server:**
  - **Consists of a server and a set of client tools that can be used to delegate and retrieve credentials to and from a server.**
  - `myproxy-init -s <host_name> -d -n`
    - `-s <host_name>` specifies the hostname of the myproxy server
  - `myproxy-info`
    - Get information about stored long living proxy
  - `myproxy-get-delegation`
    - Get a new proxy from the MyProxy server
  - `myproxy-destroy`
- **A service running continuously can renew automatically a proxy created from a long term use proxy and use it to interact with the Grid**

MyProxy

Consists of a server and a set of client tools that can be used to delegate and retrieve credentials to and from a server.

MyProxy Client commands:

- *myproxy-init*
- *myproxy-info*
- *myproxy-destroy*
- *myproxy-get-delegation*
- *myproxy-change-pass-phrase*

```
// myproxy-info -s <host name> -d
```

```
// myproxy-get-delegation -s <host name> -d
   -t <hours> -o <output file> -a <user proxy>
```

The ***myproxy-init*** command allows you to create and send a delegated proxy to a MyProxy server for later retrieval; in order to launch it you have to assure you're able to execute the grid-proxy-init or vomsproxy-init command.

```
myproxy-init -s <host name> -t <hours> -d –n
```

The myproxy-init command stores a user proxy in the repository specified by <host name> (the –s option). Default lifetime of proxies retrieved from the repository will be set to <hours> (see -t) and no password authorization is permitted when fetching the proxy from the repository (the -n option). The proxy is stored under the same user-name as is your subject in your certificate (-d).

Virtual Organizations and authorization

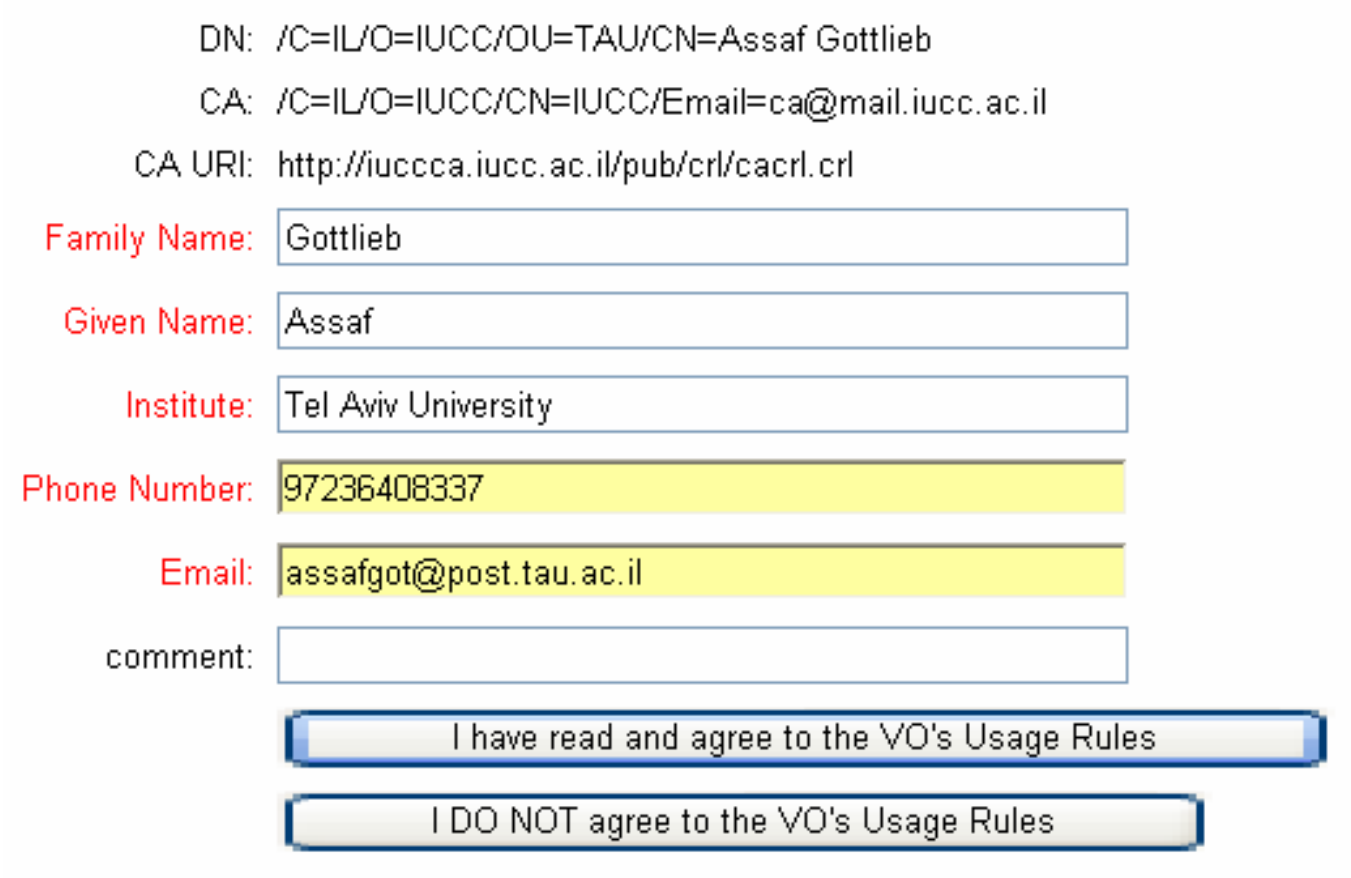
- **gLite users MUST belong to a Virtual Organization**
  - Sets of users belonging to a collaboration
  - Each VO user has the same access privileges to Grid resources
  - List of supported VOs:
    - https://lcg-registrar.cern.ch/virtual_organization.html
- **VOs maintain a list of their members**
  - The list is downloaded by Grid machines to map user certificate subjects to local “pool” accounts: only mapped users are authorized in gLite

```
...
"/C=CH/O=CERN/OU=GRID/CN=Simone Campana 7461" .dteam
"/C=CH/O=CERN/OU=GRID/CN=Andrea Sciaba 8968" .cms
"/C=CH/O=CERN/OU=GRID/CN=Patricia Mendez Lorenzo-ALICE" .alice
...
```

  - Sites decide which VOs to accept
  - A list of supported VOs can be found here:
    - *https://lcg-registrar.cern.ch/virtual_organization.html*

Singing for a VO

- **Major VOs can be joined through https://lcg-registrar.cern.ch/cgi-bin/register/account.pl**



List of VOs

VO	LHC Affiliation
ALICE	ALICE experiment
ATLAS	ATLAS experiment
CMS	CMS experiment
DTEAM	Grid (LCG) Deployment Group
LHCB	LHCb experiment
SixTrack	Single Particle Tracking Code

VO	non-LHC Affiliation
BaBar	BaBar experiment
D0	D0 experiment
H1	H1 experiment
Zeus	Zeus experiment
ILC	ILC Community
Biomed	EGEE Biomedical activity
ESR	Earth Science Research
EGEODE	Expanding GEOsciences on DEmand
PhenoGrid	Particle Physics Phenomenology

+ regional VOs (SEE – South East Europe)

Summary

- **In order to use the grid a user must have**
  - A valid certificate, given by the CA
  - Join a VO.
- **Each action on the grid requires a valid Proxy, generated from your certificate.**
- **Long duration jobs can use MyProxy server for automatic generation of proxies.**
- **Instructions available at http://iag.iucc.ac.il/workshop-2006II/JoinGrid.htm**