Authorisation and Authentication in gLite

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Acknowledgements

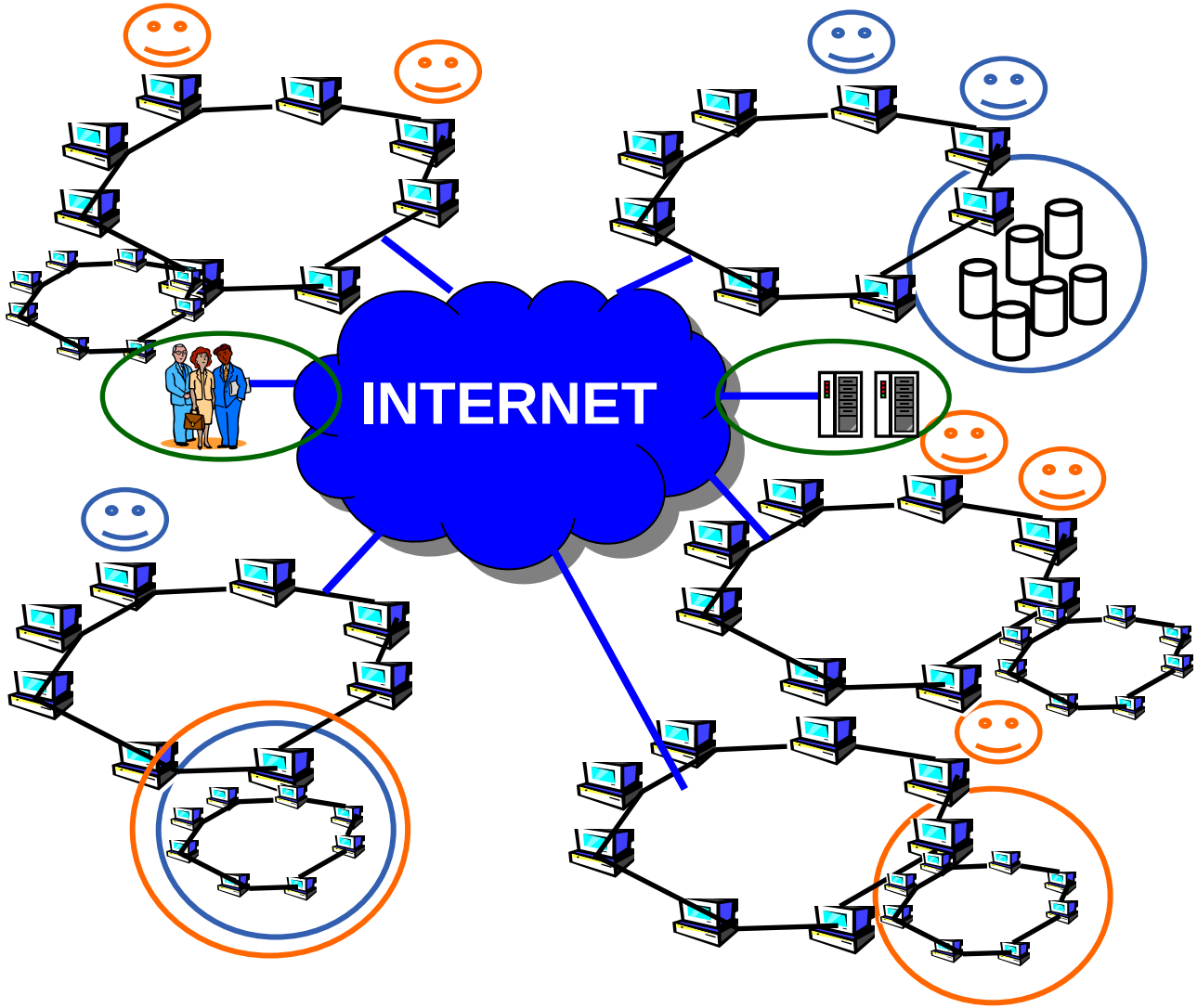
- **This presentation includes slides taken from the following talks:**
  - Roberto Barbera at ISSGC05, Vico Equense, July 2005 http://www.dma.unina.it/~murli/GridSummerSchool2005/index.htm
  - Richard Sinnott at ISSGC05, Vico Equense, July 2005
  - Carl Kesselman, at ISSGC04, Vico Equense, July 2004 http://www.dma.unina.it/~murli/GridSummerSchool2004/index.htm
  - David Fergusson at EMBRACE/EGEE Tutorial, Clermont Ferrand, July 2005 http://agenda.cern.ch/fullAgenda.php?ida=a053765
  - Joachim Flammer at EMBRACE Tutorial, Clermont-Ferrand, July 2005
- **Also information from:**
  - Globus Alliance: GT4 Security: Key concepts
  - http://www.globus.org/toolkit/docs/4.0/security/key

Outline

- **Why Authorisation and Authentication (AA) are the basis of grids**
- **Authentication: "AuthN"**
  - "Are you who you claim to be?"
- **Delegation: building distributed systems dynamically**
- **Authorisation: "AuthZ"**
  - "What are you allowed to do?"
- **MyProxy: management of certificates**

Requirements for AuthN and AuthZ

- **Support multiple VOs across**
  - Administrative domains
  - National borders
  - Via Internet
- **Single sign-on**
  - Multiple services
  - Delegation
- **Scalability:**
  - N,000 users
  - M,000 CPUs
  - Without M*N million usernames / passwords…
- **Security**



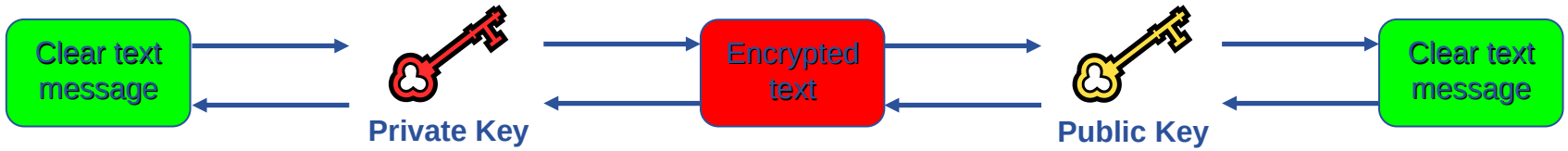
Authentication and X.509 certificates

AA and Certificates

- **X 509 Digital certificate is the basis of AA in EGEE**
- ***Certification Authorities* (CAs)**
  - ~one per country; builds network of “Registration Authorities” who issue certificates
- ***CAs are mutually recognized* – to enable international collaboration**
  - International Grid Trust Federation http://www.gridpma.org/
- **For Asia-Pacific region CAs: https://www.apgrid.org/CA/CertificateAuthorities.html**
- **CA certificates – issued to**
  - Users: you get a Certificate and use it to access grid services
  - Sites providing resources
- **Uses Public Key Infrastructure**
  - Private key – known only to you
  - Public key included in your certificate

Public Key Infrastructure

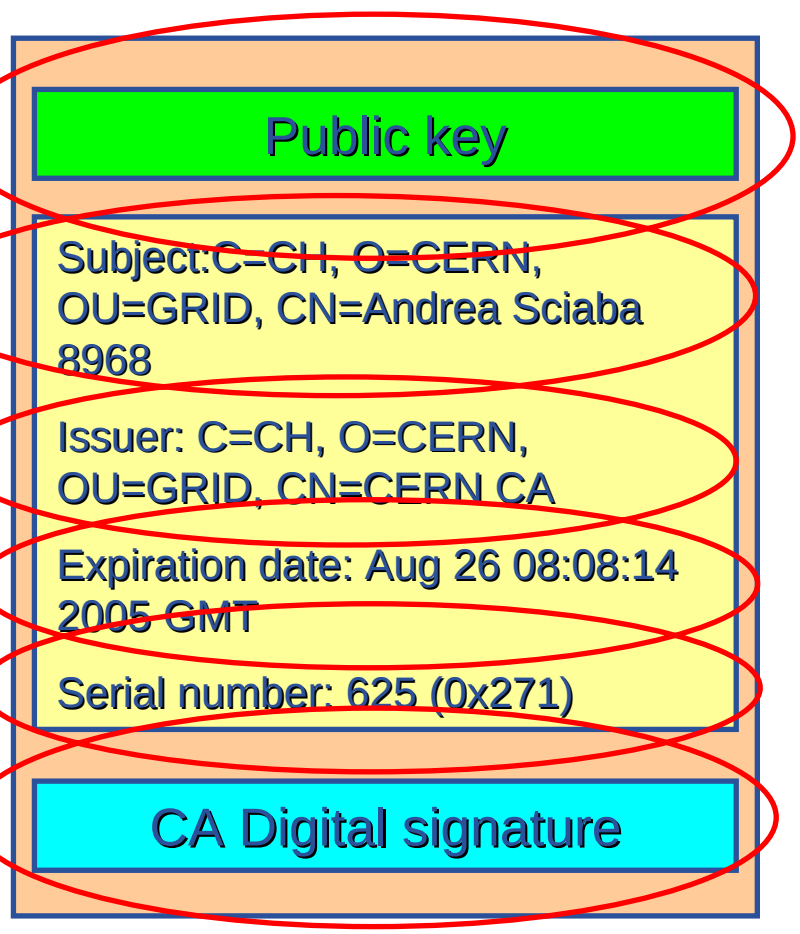
- **Basis for authentication, integrity, confidentiality, non-repudiation**
- **Asymmetric encryption**



- **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 mode**
  - Keys trusted only if signed by a trusted third party (Certification Authority)
  - A CA certifies that a key belongs to a given principal
- **Certificate: held in two parts**
  - Public key + principal information + CA signature
  - Private key: only the owner (should) use this

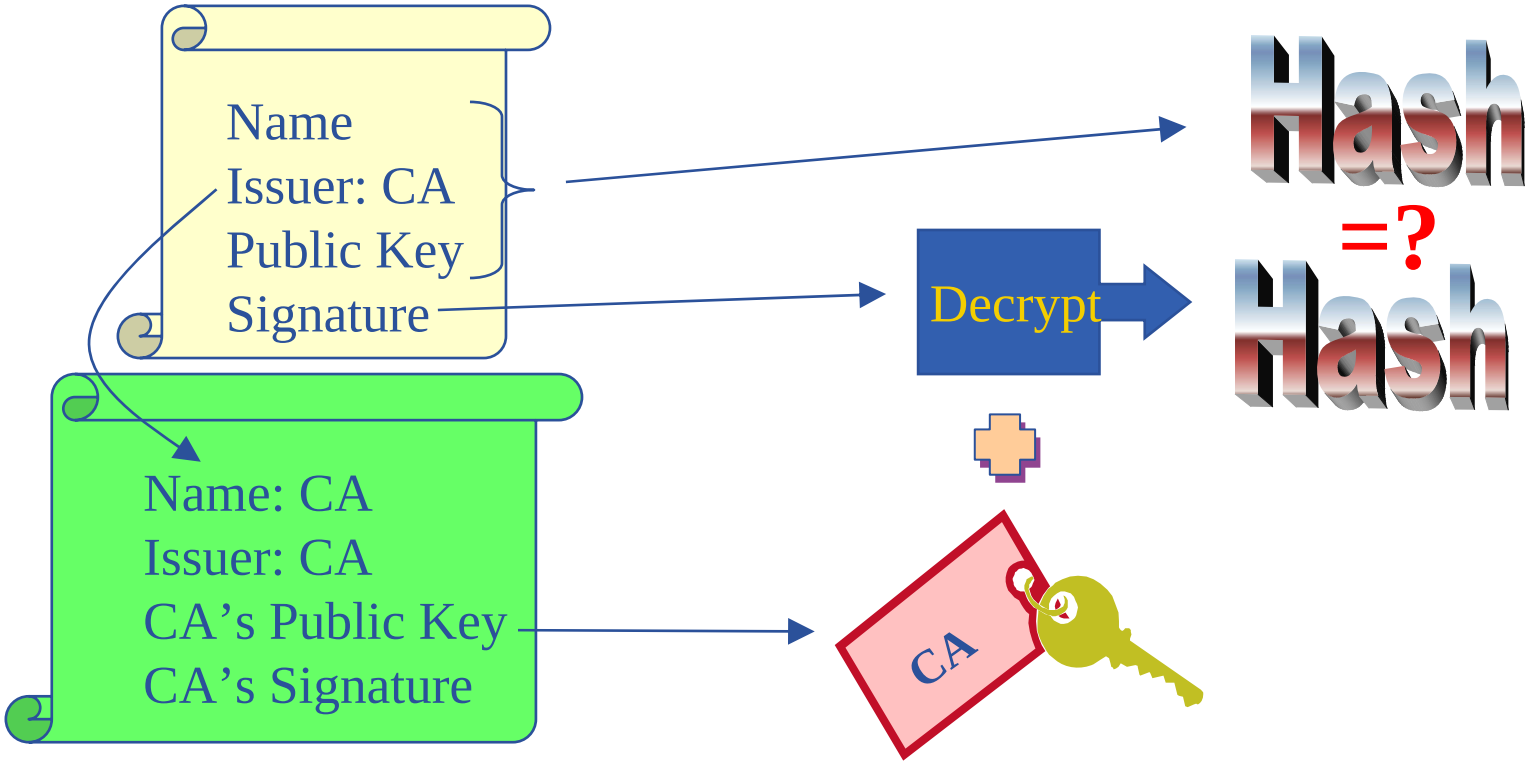
X.509 Certificates

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



Certificate Validity

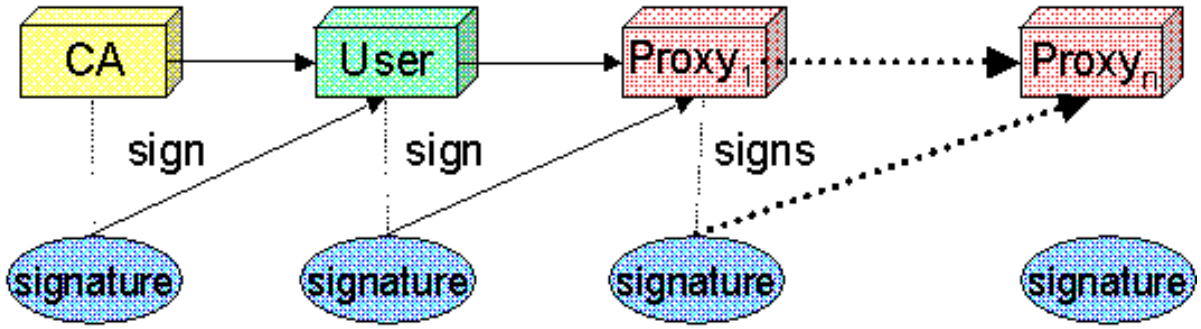
- **The public key from the CA certificate can then be used to verify the certificate.**



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

Grid Security Infrastructure (GSI)

- ***de facto* standard for Grid middleware**
- **Based on PKI**
- **To support….**
  - Single sign-on: to a machine on which your certificate is held
  - Delegation: a service can act on behalf of a person
  - Mutual authentication: both sides must authenticate to the other
- **….GSI introduces proxy certificates**
  - Short-lived certificates signed with the user's certificate or a proxy
  - Reduces security risk, enables delegation

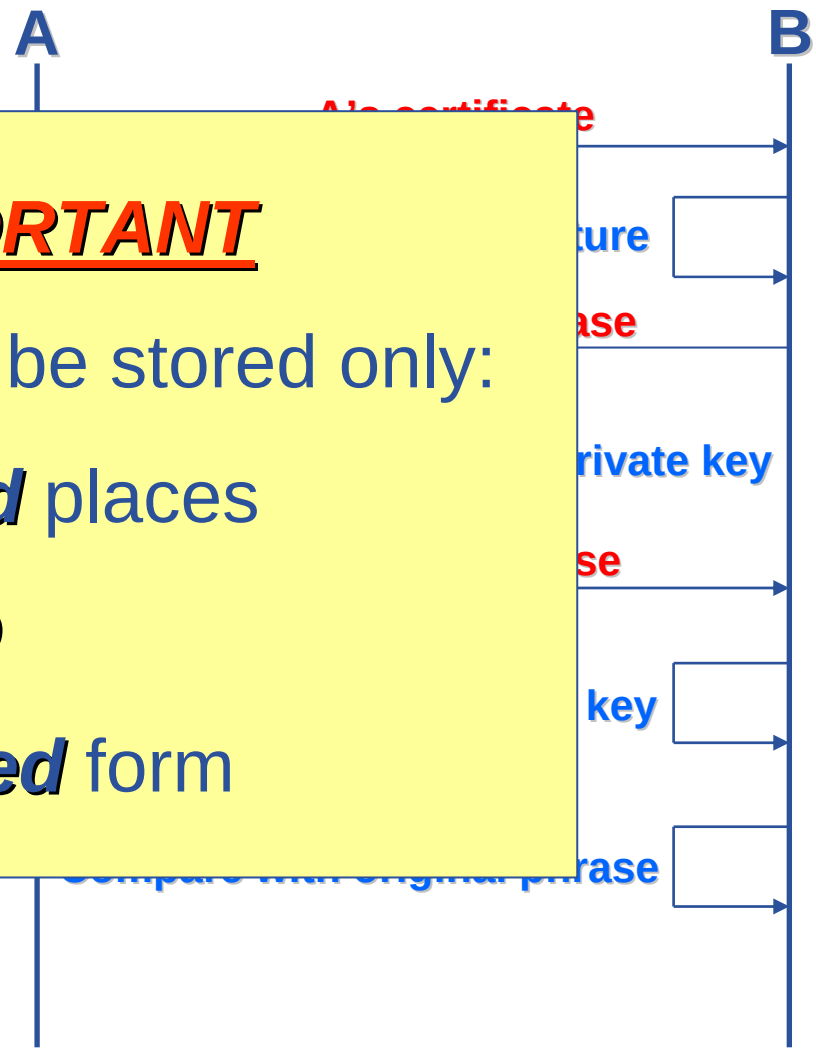


- CA and user included in the proxy.. .. See practical later

The Grid Security Infrastructure (GSI)

Based on X.509 PKI:

- **every us**
  certifica
- **certifica**
  the loca
- **every Gr**
  authentic
  1. A se
  2. B ve
  3. B se
  4. A en
     priva
  5. A se
  6. B us
     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.



VERY IMPORTANT

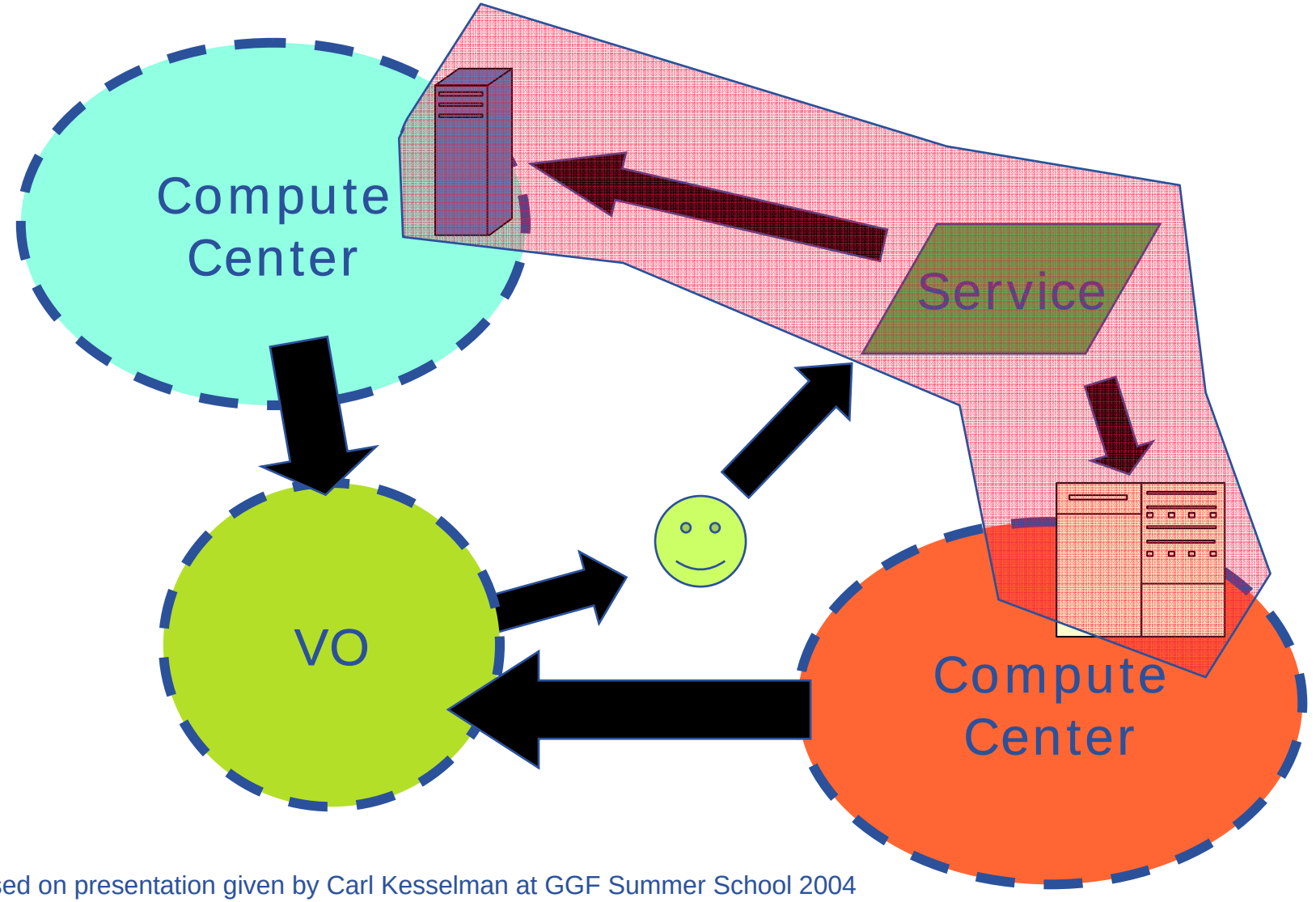
Private keys must be stored only:

in ***protected*** places

AND

in ***encrypted*** form

Use Delegation to Establish Dynamic Distributed System



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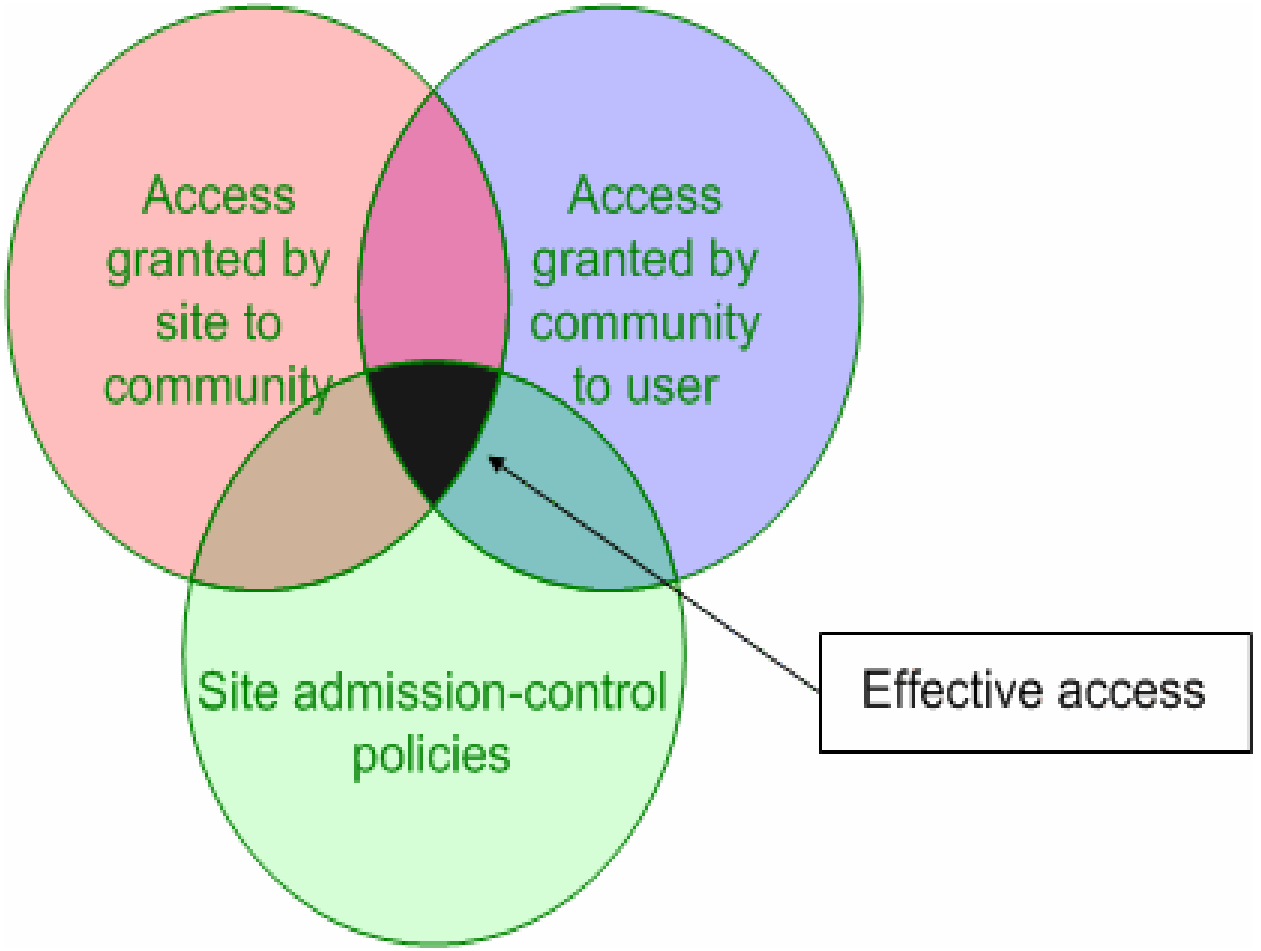
User Authorisation to Access Resource



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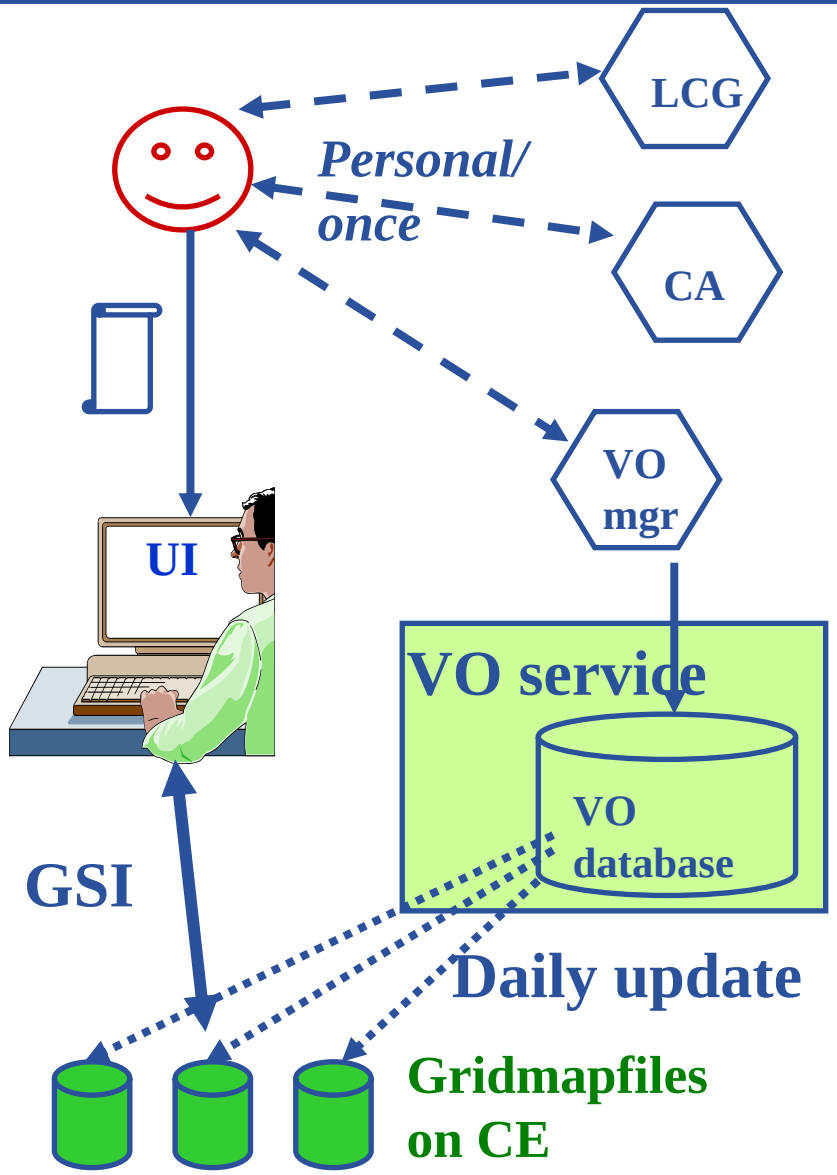
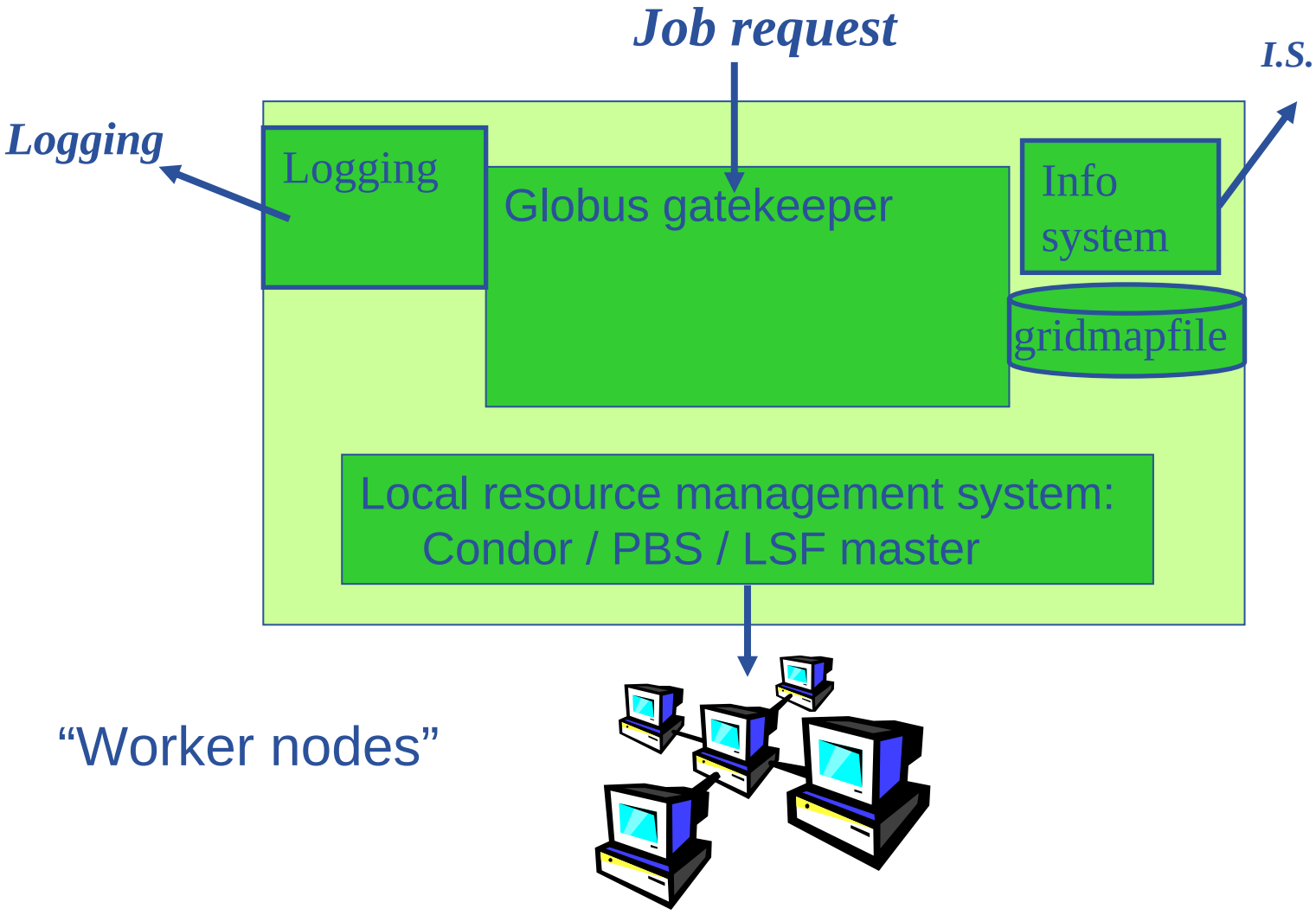
Authentication, Authorisation in LCG

- **Authentication**
  - User certificate signed by CA
  - Connects to UI by ssh
  - Downloads certificate
  - Invokes Proxy server
  - **Single logon** – to UI - then **Grid Security Infrastructure identifies user to other machines**

- **Authorisation**
  - User joins Virtual Organisation
  - VO negotiates access to Grid nodes and resources
  - Authorisation tested by CE
  - gridmapfile maps user to local account



"Compute element"



Building on AuthN

- Authorisation…
- What are you allowed to do?
- … and how is this controlled??
- In gLite the answer will be VOMS
- Virtual Organisation Management System

EGEE VO management face to face

LCG

- **User is authorised as a member of a single VO**
- **All VO members have same rights**
- **Gridmapfiles are updated by VO management software: map the user's DN to a local account**
- **grid-proxy-init**

gLite, using VOMS *In future…*

- **User can be in multiple VOs**
  - Aggregate rights
- **VO can have groups**
  - Different rights for each
    - Different groups of experimentalists
    - …
  - Nested groups
- **VO has roles**
  - Assigned to specific purposes
    - E,g. system admin
    - When assume this role
- **Proxy certificate carries the additional attributes**
- **voms-proxy-init**

VOMS: virtual organisation management system

- single login using voms-proxy-init only at the beginning of the session (was grid-proxy-init)
- backward compatibility: the extra VO related information is in the user's proxy certificate, which can be still used with non VOMS-aware services
- multiple VOs: the user may "log-in" into multiple VOs and create an aggregate proxy certificate, which enables her to access resources in any of them

Introduction to VOMS

- **VOMS Features**
  - Single login using (proxy-init) only at the beginning of a session
    - Attaches VOMS attributes to user proxy
  - Expiration time
    - The authorization information is only valid for a limited period of the time as the proxy certificate itself
  - Multiple VO
    - User may log-in into multiple VOs and create an aggregate proxy certificate, which enables him/her to access resources in any one of them
  - Backward compatibility
    - The extra VO related information is in the user's proxy certificate
    - User's proxy certificate can be still used with non VOMS-aware service
  - Security
    - All client-server communications are secured and authenticated

Groups

- **The number of users of a VO can be very high:**
  - E.g. the experiment ATLAS has 2000 members
- **Make VO manageable by organizing users in groups:**
  - VO BIOMED-FRANCE
    - Group Paris
      - *Sorbonne University*
        - Group Prof. de Gaulle
      - *Central University*
    - Group Lyon
    - Group Marseille
- **Groups can have a hierarchical structure**
- **Group membership is added automatically to your proxy when doing a *voms-proxy-init***

Groups rights

- **Assign rights to certain members of the groups**
  - using Access Control Lists (ACL) like in a file system
    - Allow / Deny
      - *Create user*
      - *Delete user*
      - *Get ACL*
      - *Set ACL*
      - *List user*
      - *Remove ACL*
  - Specifying unit for entry:
    - The local database administrator
    - A specific user (not necessarily a member of this VO)
    - Anyone who has a specific VOMS attribute FQAN
    - Anyone who presents a certificate issued by a known CA (Including host and service certificates)
    - Absolutely anyone, even unauthenticated clients

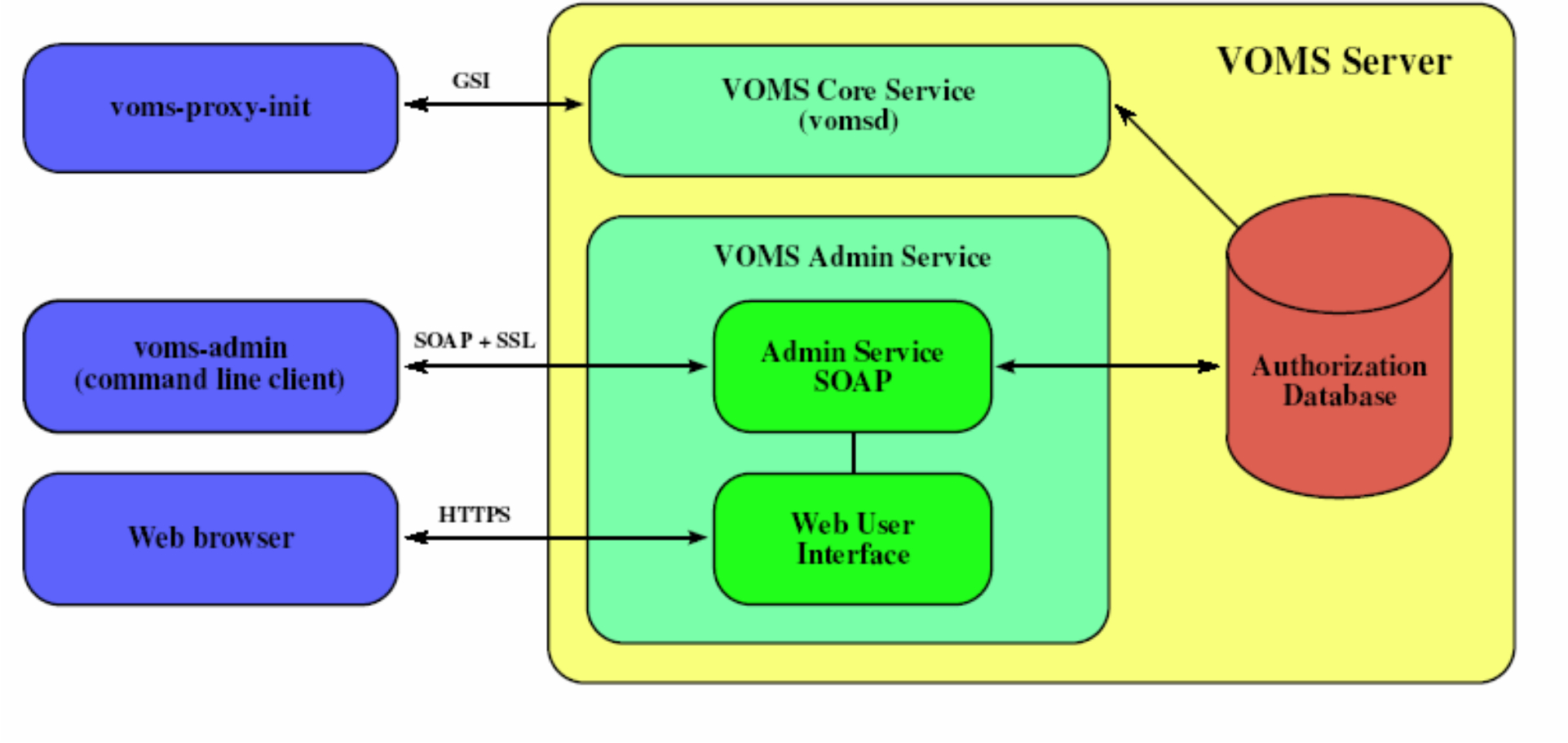
Roles

- **Roles are specific roles a user has and that distinguishes him from others in his group:**
  - Software manager
  - Administrator
  - Manager

- **Difference between roles and groups:**
  - Roles have no hierarchical structure – there is no sub-role
  - Roles are not used in 'normal operation'
    - They are not added to the proxy by default when running *voms-proxy-init*
    - But they can be added to the proxy for special purposes when running *voms-proxy-init*

- **Example:**
  - User Yannick has the following membership
    - VO=BIOMED-FRANCE, Group=Paris, Role=SoftwareManager
  - During normal operation the role is not taken into account, e.g. Yannick can work as a normal user
  - For special things he can obtain the role "Software Manager"

gLite VOMS



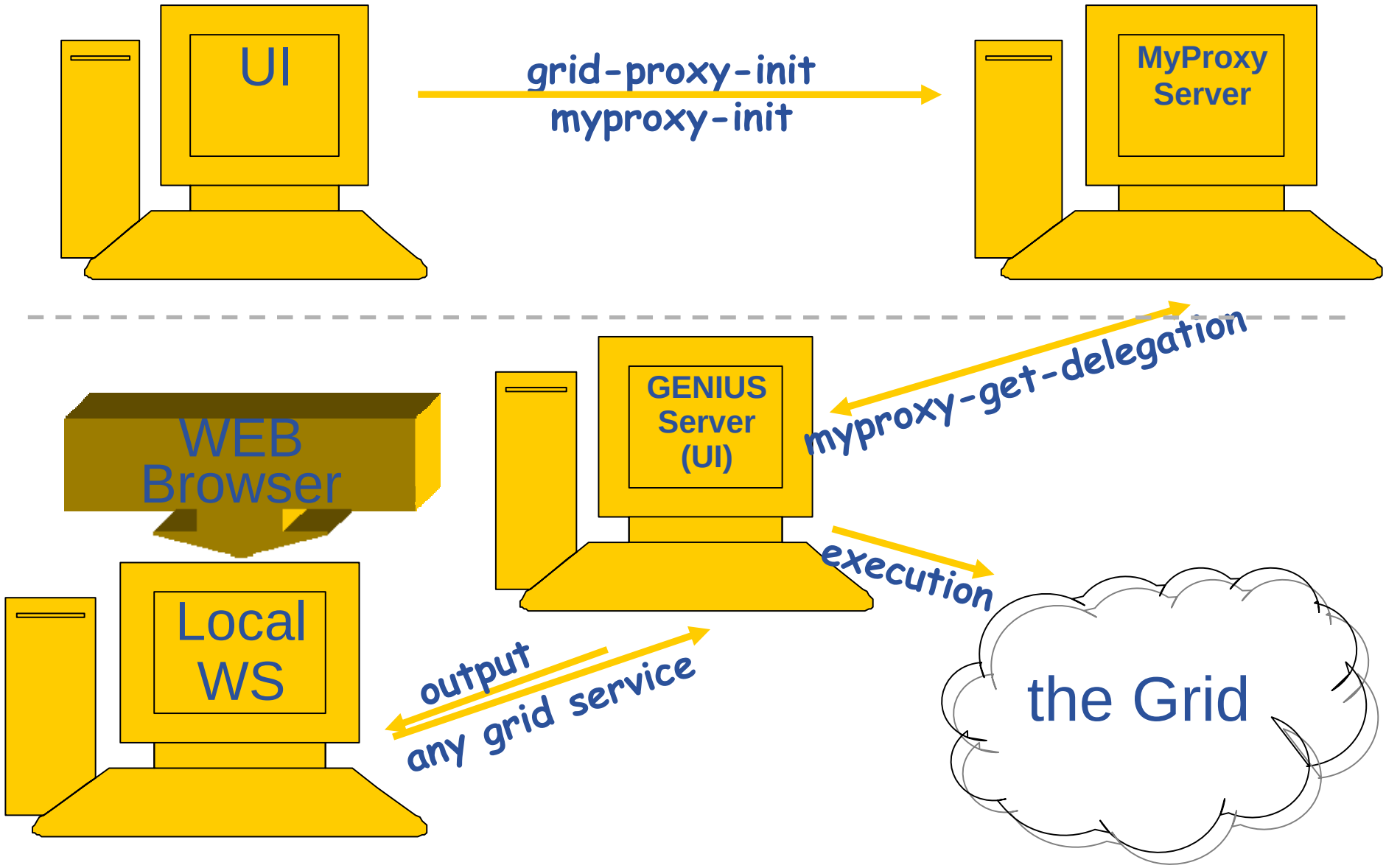
Authz DB is a RDBMS (both MySQL and Oracle are currently supported).

"MyProxy"

- **You may need:**
  - To interact with a grid from many machines
    - And you realise that you must NOT, EVER leave your certificate where anyone can find and use it…. Its on a USB drive only.
  - To use a portal, and delegate to the portal the right to act on your behalf (by logging in to an account that can make a proxy certificate for you)
  - To run jobs that might last longer than the lifetime of a short-lived proxy

- **Solution: you can store a long-lived proxy in a "MyProxy repository" and derive a proxy certificate when needed.**

Grid authentication with MyProxy



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).

Summary -1

- **Digital credentials and the "Grid Security Infrastructure" (GSI) are the basis of AuthN and AuthZ**
- **Need to establish trust, so**
  - Resource can trust user
  - User can trust the resource
- *The basis:*
  - ***both users and sites trust Certificate Authorities***
  - ***CAs trust each other***
  - ***CAs sign user and site certificates***

Protect your certificate: it is your grid identity

Summary -2

- **The EGEE multi-VO grid is built on**
  - Authentication based on X.509 digital certificates
    - Issued by CAs that are internationally recognised (hence we can have international collaboration)
    - With proxy extensions
  - Authorisation
    - gLite will be using VOMS – not yet, in GILDA
- **VOMS supports**
  - multiple groups, roles within a VO
  - Aggregation of rights by a user who is a member of several VOs
- **MyProxy**
  - Secure storage of certificates and proxies
  - Delegation so services can create and use a proxy on your behalf

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

References

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