Distributed Data Access Control Mechanisms and the SRM

Peter Kunszt

Manager Swiss Grid Initiative
Swiss National Supercomputing Centre CSCS
GGF Grid Data Management Working Group Co-Chair

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Building the Science Database of the Sloan Digital Sky Survey,
Johns Hopkins University Baltimore

EU Grid Projects, leading data management middleware development
CERN, Geneva

Grid Storage Management Working Group Co-Chair
Global Grid Forum

Manager Swiss Grid Initiative,
Swiss National Supercomputing Centre
CSCS, Manno

Outline

Introduction: Distributing Data Security Aspects

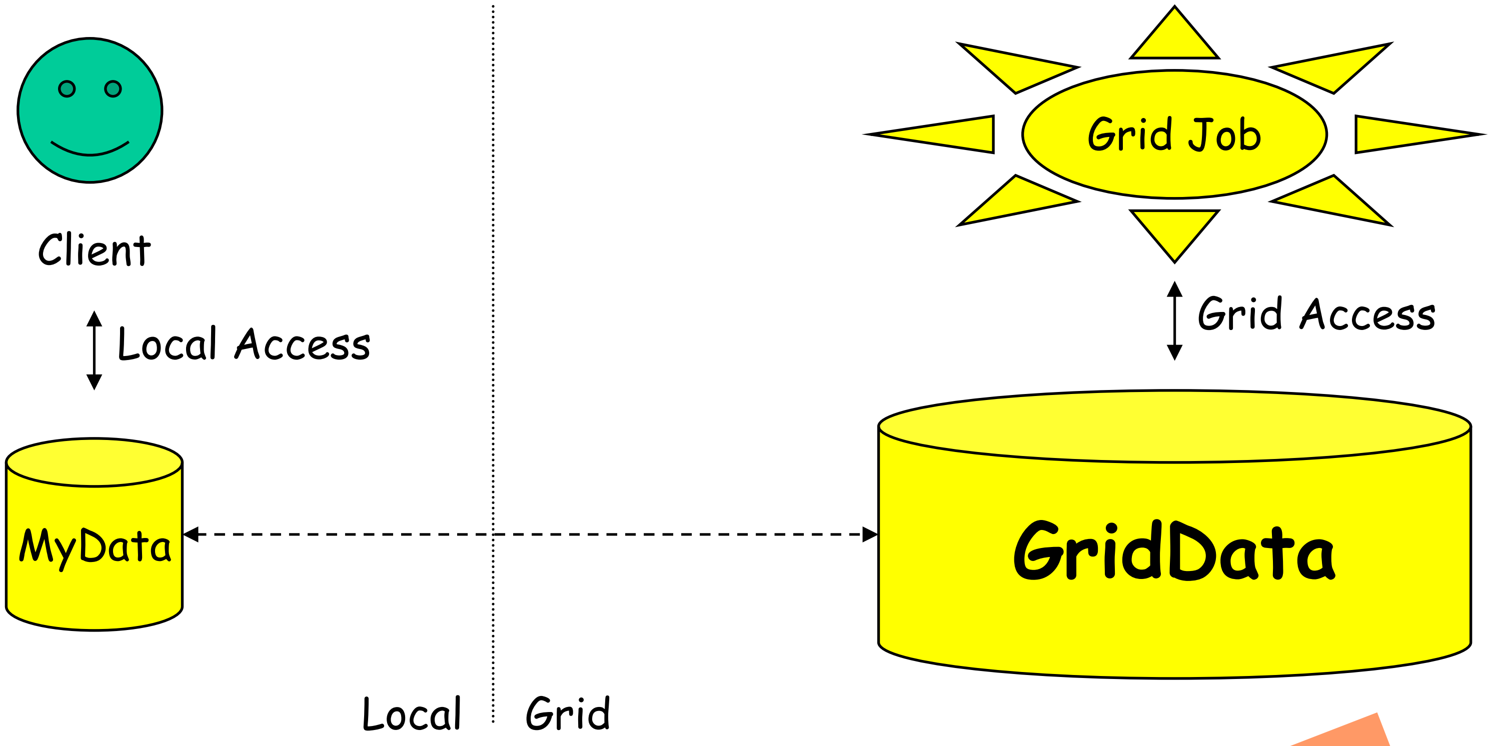
- Ubiquitous Access to Data(?)
- Semantic models
- Trust relationships

Discussion of Possible Security Models

EGEE and SRM models

Ubiquitous Distributed Data Security

Use Case : Ubiquitous Data Access



Same Semantics Expected

Or Not??

Data Access Semantics

Local: Security fully controlled by the Owner

- Setting and Getting of Permissions and ACLs
- Changes have Instantaneous effect

Distributed: Different Security Models

- **Single Master, Read-Only Copies**
  - Changes only possible in one place, effect on copies not instantaneous
- **Multi Master**
  - Changes possible everywhere, complex synchronization
  - Race Conditions
  - Resolution of Conflicts may involve human decisions
- **No Synchronization** (Peer-to-Peer)
- **Any combination of the three above**
  - Hierarchical models
  - Caches

Trust Relationships

Local : Client and Resource interact directly

- Client trusting the local Storage to enforce the access model
- Client trusting the local Resource Owners not to abuse data
- Resource Owners trusting Clients not to put ‘bad’ data on resource

Grid : VO trust layer between Client and Resource

- VO trusting Resource to enforce access
- VO trusting Resource Owners not to abuse data
- Resource trusting VO not to place ‘bad’ data into resource
- Client trusting VO to maintain the trust relationships properly on its behalf

Distributed Data Security Models

Policy Decision Point PDP

- Decisions about Clients being able to access Data

Policy Enforcement Point PEP

- Enforcing the PDP decision, strong trust relationship between PEP and PDP
- Enforcement can only be done by the Recource Owners

Models different depending on the placement of PDP and PEP in the Grid Layered Architecture

- 5 Models possible

Policy Enforcement and Decision Points

			PDP	PDP	Service Owner:**VO** Application Layer
	PDP	PDP PEP		PEP	Service Owner:**Site** Middleware Layer
PDP PEP	PEP		PEP		Service Owner:**Site** Resource Layer
Model 1	Model 2	Model 3	Model 4	Model 5	

Model 1: Site Security Only

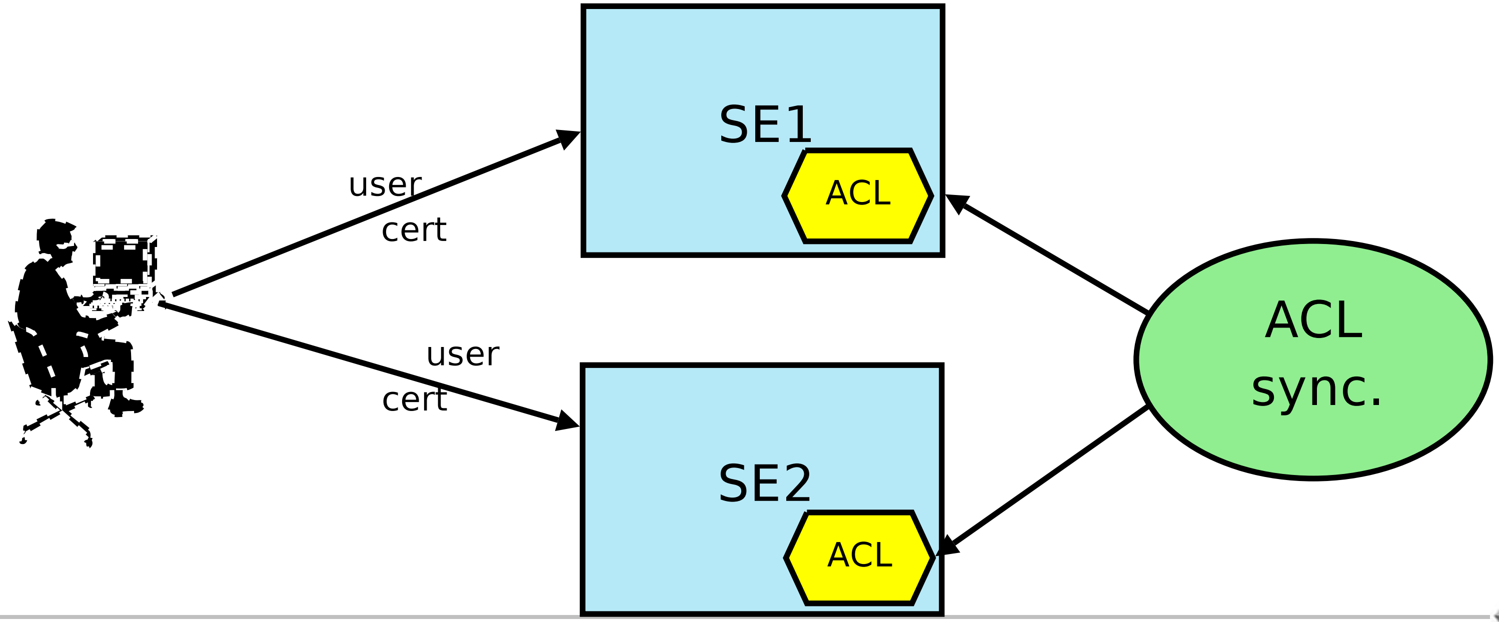
Both PDP and PEP are in the Resource Layer

- Integrated Storage Resource model
- Full control of the Storage of the Site/Resource Owner
- Mapping necessary between
  - Grid Users and Site Users
  - Grid Data names and Site Data names (logical vs. physical names)
  - Local Namespace is relevant as it holds access semantics
- Issues with distributed access
  - Peer to peer maps well onto this model
  - For single master and multi master, synchronization between local instances is needed
  - Job scheduling needs to take individual access capabilities into account in addition of the data being present or not

Model 1: Site Security Only

Implementation possibility:

- Client is accessing each storage individually, directly
- Client has proper credentials for **each** local storage element
- For non P2P models, synchronization is necessary
- Possible standardization problems as individual storages have potentially different ACL interpretations



Model 2: Middleware PDP, Site PEP

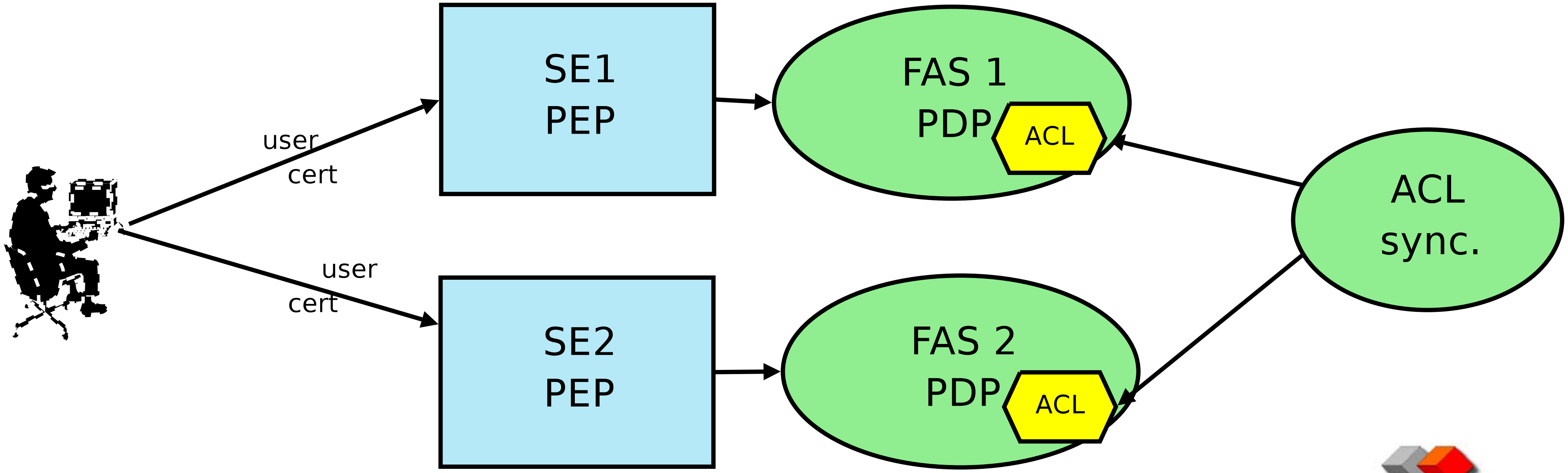
PDP is on site but in the Grid Layer. PEP in the Resource Layer

- Storage Resource delegates decision on access to the middleware
- On-site middleware so resource owners are still in control
  - Well suited for sites running local storage with limited semantics
- Mappings: same as M1
  - User, filename mappings still needed
  - ACLs/Security metadata stored now in the Grid Layer
- Issues with distributed access
  - Peer to peer maps well onto this model too
  - For single master and multi master, synchronization between local instances is still needed
  - Job scheduling needs to take individual access capabilities into account in addition of the data being present or not.

Model 2: Middleware PDP, Site PEP

Implementation possibility:

- A middleware: File Authorization Service FAS needed as PDP
- Client is accessing each storage individually, directly
- Client has proper credentials for **each** local storage element
- For non P2P models, synchronization is still necessary
- Lesser standardization problems as M1: middleware abstraction



Model 3: Middleware Control

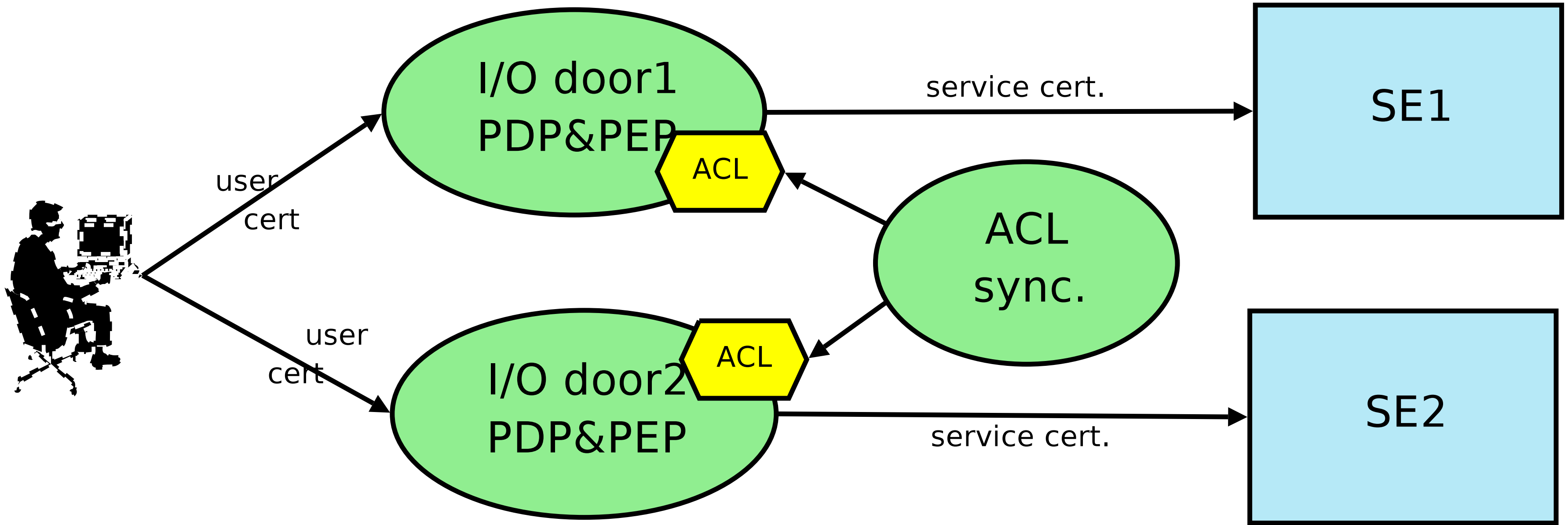
Middleware Layer controls both PEP and PDP

- Storage can only be accessed through the Middleware Layer
- On-site middleware so resource owners are still in control
- Mappings are managed by the Middleware
  - Abstraction of local storage semantics and namespace
  - ACLs/Security metadata stored and enforced in the Grid Layer
- Issues with distributed access
  - Peer to peer is still a good model, each site now has uniform semantics
  - For single master and multi master, synchronization between local instances is still needed
  - Job scheduling needs to take individual access capabilities still into account in addition of the data being present or not.

Model 3: Middleware Control

Implementation possibility:

- Middleware service acting as Door to the storage, keeping ACLs locally
- Client cannot access the Storage Element directly
- Client needs credentials **only** for the middleware
- Middleware **owns** the data on the SE and accesses it using a service cert



Model 4: VO PDP, Site PEP

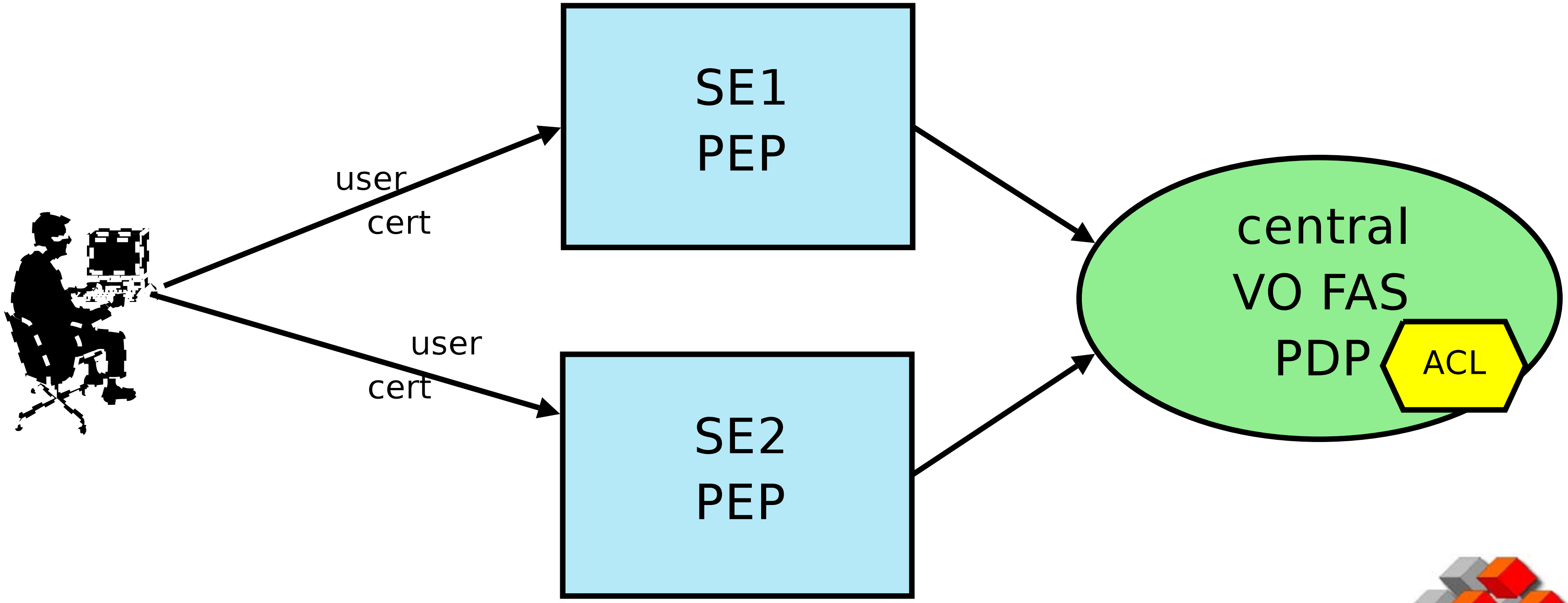
VO Layer controls the Decision making

- Storage is accessed directly by Clients as in Model 2
- The Decision is not an on-site service so the resource owners have to delegate the decision making to the VO, only enforcing it locally
- Mappings are managed by the VO
  - Abstraction of local storage semantics and namespace now up to the VO layer
  - ACLs/Security metadata managed by the applications but is a single point of failure
- Issues with distributed access
  - Peer to peer is not necessarily a good model as a potentially central VO service would need to be contacted for every operation
  - The VO PDP needs to decide whether to enforce single master or multi master, but can do so relatively easily
  - Job scheduling does not need to take individual site access into account.

Model 4: VO PDP, Site PEP

Implementation possibility:

- Storage needs a callout to the (central) VO PDP service
- Client has proper credentials for **each** local storage element
- No standardization needed



Model 5: VO PDP, Middleware PEP

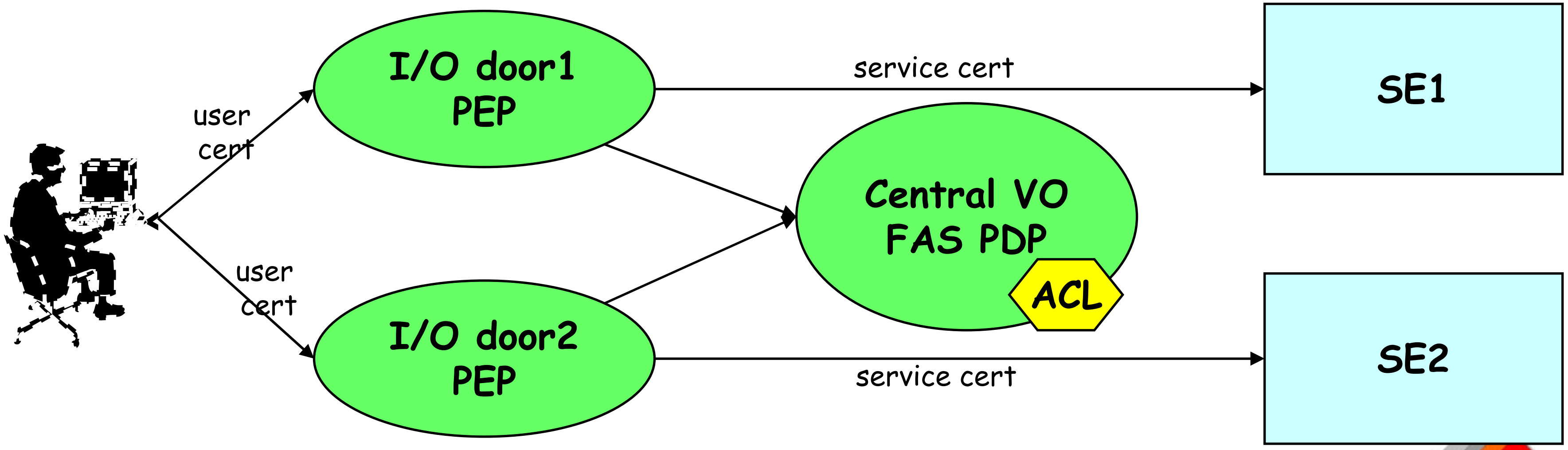
Middleware Layer controls PEP while VO maintains PDP

- Storage can only be accessed through the Middleware Layer as in Model 3
- Everything else as in Model 4

Model 5: VO PDP, Middleware PEP

Implementation possibility:

- Middleware service acting as Door to the storage but access control info is in the central PDP
- Client cannot access the Storage Element directly
- Client needs credentials **only** for the middleware
- Middleware **owns** the data on the SE and accesses it using a service cert

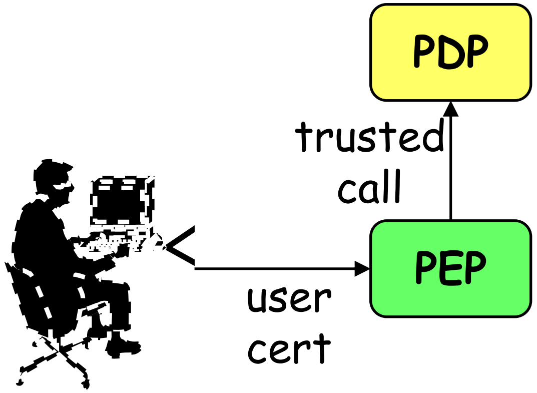


Alternative Implementations

Possible depending on how the communication between PDP and PEP is being done:

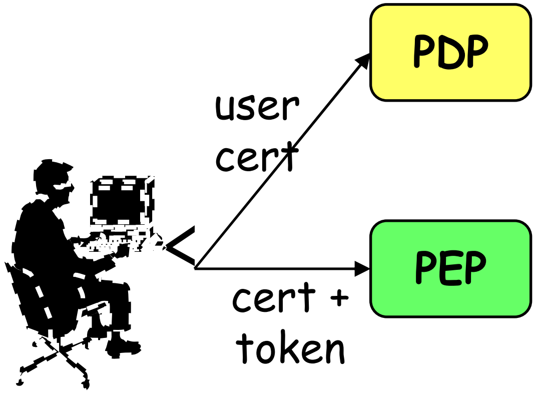
Pull

- Call-out from the PEP to the PDP
- Also called 'late' authorization as the decision is made very late in the process



Push

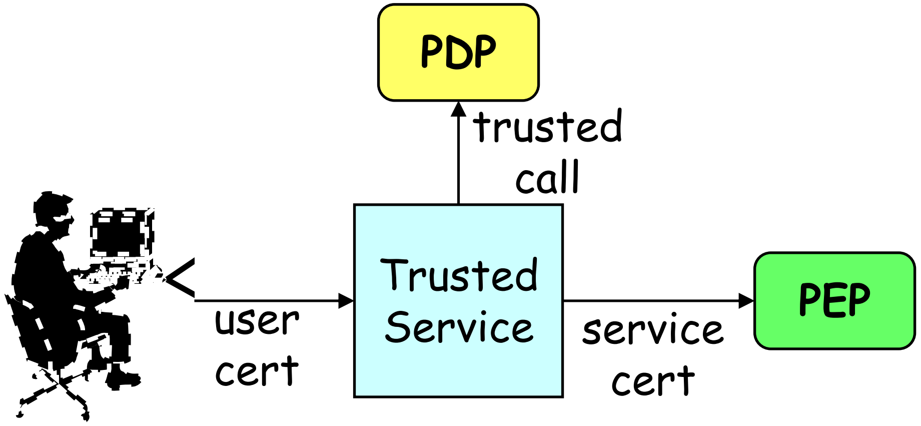
- User gets a token signed by the PDP
- User claims to have the rights on the data directly based on the secure token
- Also called 'external' authorization



Alternative Implementations

Trusted

- User entrusts a service to act on its behalf
- Service retrieves PDP info on behalf of user
- Service has ‘admin’ capabilities on PEP



SRM security

The current SRM security runs with **Model 1**

SRM v1 and v2

- Model 1 not by design but by default. For Model 1, the Pull implementation is trivial as the PDP and PEP are the same
- Discussions did not even start!
- If SrmCopy is not used, any model can be implemented on top of the SRM.
- SrmCopy in v1 and v2 only allows Model 1 by default, using the Peer to Peer security option (no synchronization on update).

SRM v3

- Foresees proper handling of ACLs with the necessary methods
- May be extended to include synchronization between sites also for SrmCopy
- Detailed discussions also to be had. SRM v3 is simply flexible enough to allow for any security model.

EGEE security model: gLite 1.5

The EGEE gLite versions up to v1.5 were designed to run with **model 3 or 5.**

Model 5

- gLite I/O: middleware service acting as door ('trusted' implementation as the actual enforcement is done by the SE)
- gLite Fireman Catalog: central VO-owned service

Model 3

- gLite I/O as door (trusted impl)
- gLite Fireman deployed locally at each site
- Synchronization between Fireman catalogs through a messaging service

EGEE security model: LCG and gLite3

The EGEE versions up to LCG 2.7 and starting gLite3 run with **model 1.**

Model 1

- Just using the SRM
- Alternatively, directly talking to the storage at each site over the native interface (dcap, rfio) or over GFAL

Not quite Model 2

- LCG File Catalog LFC acting as namespace service only, ACLs but not enforced
- Push implementation using VOMS groups but these are not signed by the LFC
- No synchronization

AliEn

The LHC Alice experiment’s own Grid Middleware called AliEn that largely influenced the EGEE design is working with **model 4**

- ‘Push’ implementation with a token given to the service by the Alien System
- ‘Central’ Alien File Catalog – distributed instance
- Direct access to file through xrootd protocol with the service token

SRB

The Storage Resource Broker from SDSC seems to be using **Model 3**

- Central namespace service
- Every access goes through the SRB layer and is tightly controlled by it

Summary

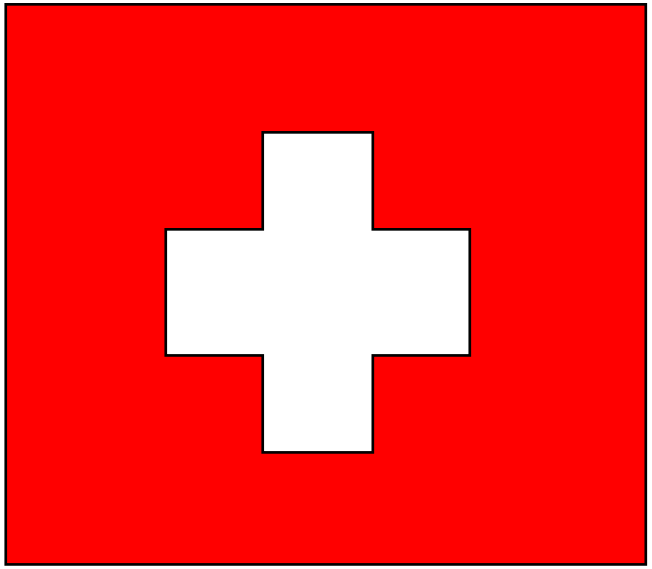
The users of a distributed Grid infrastructure need to be aware of the security semantics of their distributed data access model

- Not an easy decision which model to use
- Every model has advantages and disadvantages
- Possibly no one size fits all solution
- SRM v3 might accommodate any solution on top

- Still a lot of thinking/deciding to be done!

- .. And I haven’t even touched on the subject of co-scheduling…

..And now for the Really Important Stuff



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