Access control delegation for the Cloud

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Why do enterprises fear the cloud?

“Uncertain ability to enforce provider security policies”

“[Lack of] effective models for managing and enforcing data access policies”

Interoperability requires complex APIs which increases chances of a security breach due to implementation errors
We need a solution that...

- Performs access control on outsourced data
- Requires minimum trust to cloud providers
- Protects user credentials
- Is easy to implement
- Enables migration to other cloud providers
- Provides privacy and prevents monitoring
A new approach

• Separate data storage from data access authorization
  – Cloud providers are concerned with data storage
  – Data access authorization performed by a trusted (not always third) party: the Access Control Provider
Scheme Overview

Access Control Provider

Data Owner
They may belong to the same physical/administrative domain
Scheme Overview

Access Control Provider

Data Owner

Access control policy

URI_{ACP}

(1)

(2)
Scheme Overview

Unique large number, cannot be guessed
Scheme Overview

1. Access control policy
2. URI\_ACP
3. Data, URI\_ACP
4. Request
5. Token, URI\_ACP
6. Token, Credentials, URI\_ACP, Pub\_ACP
7. Authorization
8. Authorization

Cloud Provider

Consumer

Data Owner

Access Control Provider
Scheme

- Verify signature
- Check if URI_{ACP}, Pub_{CP} are correct
- Check lifetime
- Check level
Revisiting our requirements

✓ Performs access control on outsourced data
✓ Requires minimum trust on cloud providers
  • The cloud provider is only trusted to respect the decision of the ACP
  • Relaxed form of existing trust relationships
✓ Protects user credentials
✓ Easy to implement, allows migration
  • Data can be copied-pasted
✓ Provides privacy
  • The cloud provider learns nothing about users
...And some additional benefits

• Policies are reusable
  – The Content Provider does not know how policies work (useful for e.g. for B2B applications)

• Policies can be modified without the involvement of the cloud providers

• ACPs create the potentials of a new market
Why not OpenID or OAuth?

• OpenID
  – Identity Provider checks user credentials
  – But the Cloud Provider checks the policy
  – The Cloud Provider knows who the user is

• Oauth
  – Identity Manager verifies user attributes
  – But the Cloud Provider checks policy attributes
  – The Cloud Provider knows the user attributes
Attacks deflected

• Attack scenarios by Wang et al., SSP 2012
• Switching policy from legal A to illegal B
  – The ACP includes the policy in the signature
• Cloud provider B seeing data in provider A
  – The ACP includes B’s key in the signature
• Pretending to be another user of the system
  – The CP knows who asked for each token
  – This worked on facebook and twitter...
Implementation

- On top of Swift (object storage system)
  - Component in Swift pipeline
  - Uses HTTPS for communication
Middleware for

Google Drive

amazon Web Services S3
Thank you

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