Access control delegation for the Cloud

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Why do enterprises fear the cloud?

pwc

“Uncertain ability to enforce provider security policies”

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

enisa

European Network and Information Security Agency

CSA cloud security alliance®

Interoperability requires complex APIs which increases chances of a security breach due to implementation errors

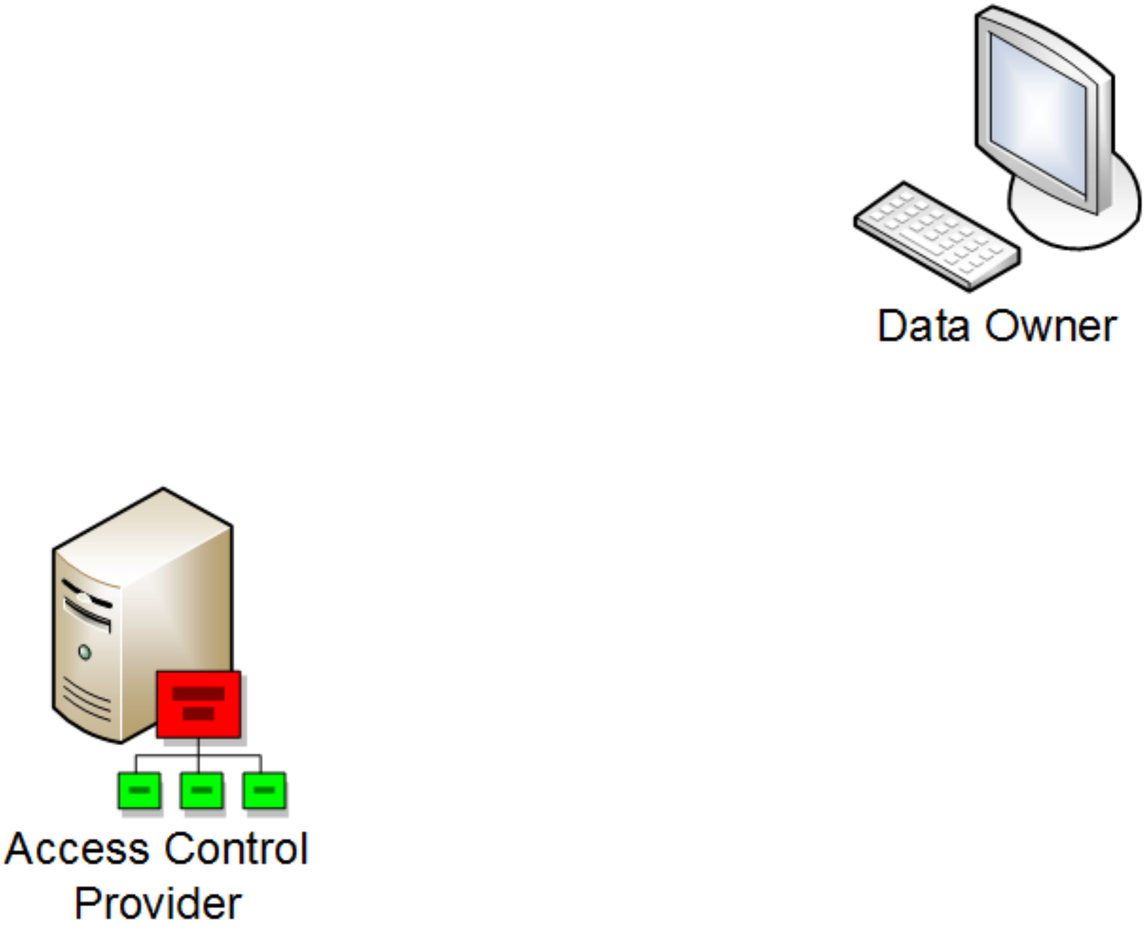
We need a solution that…

- 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

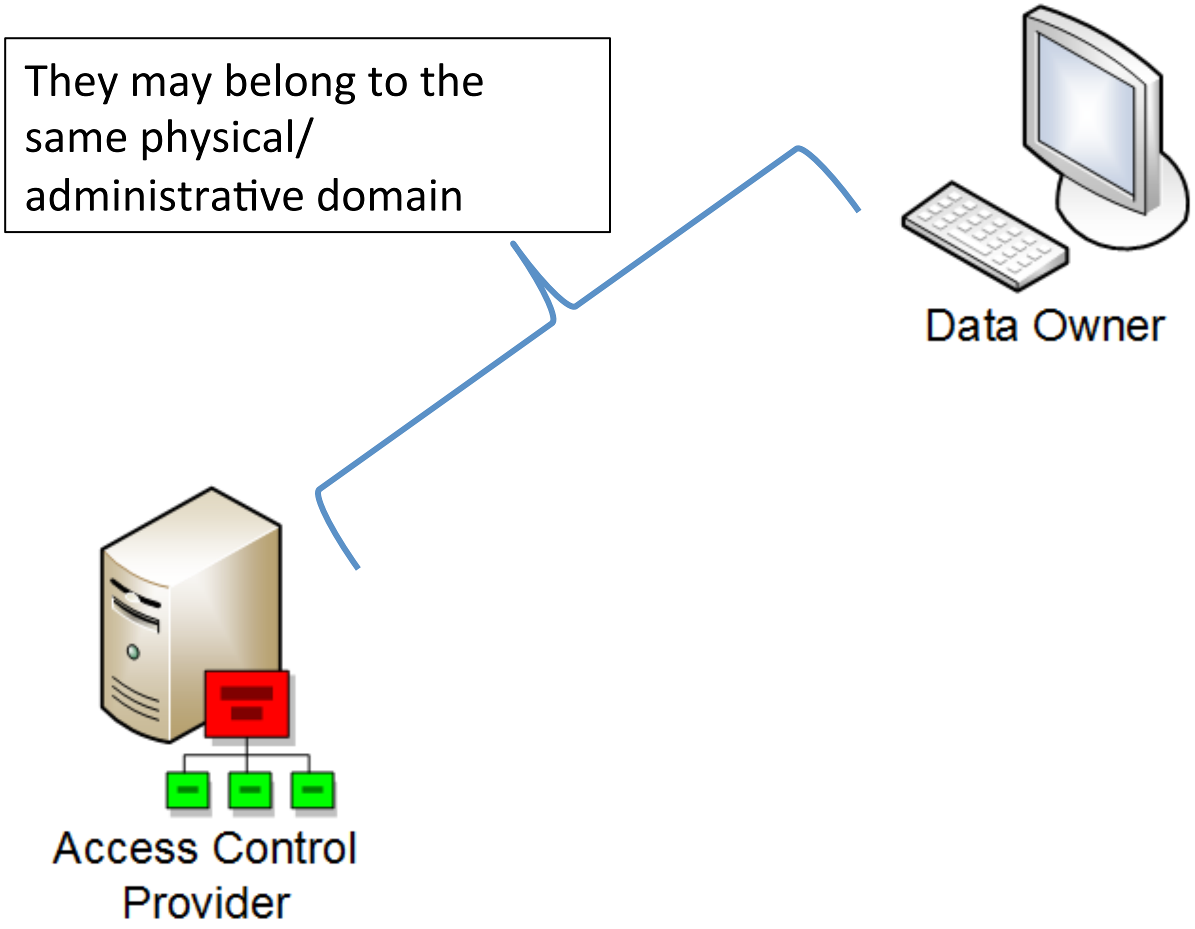
Scheme Overview



Data Owner

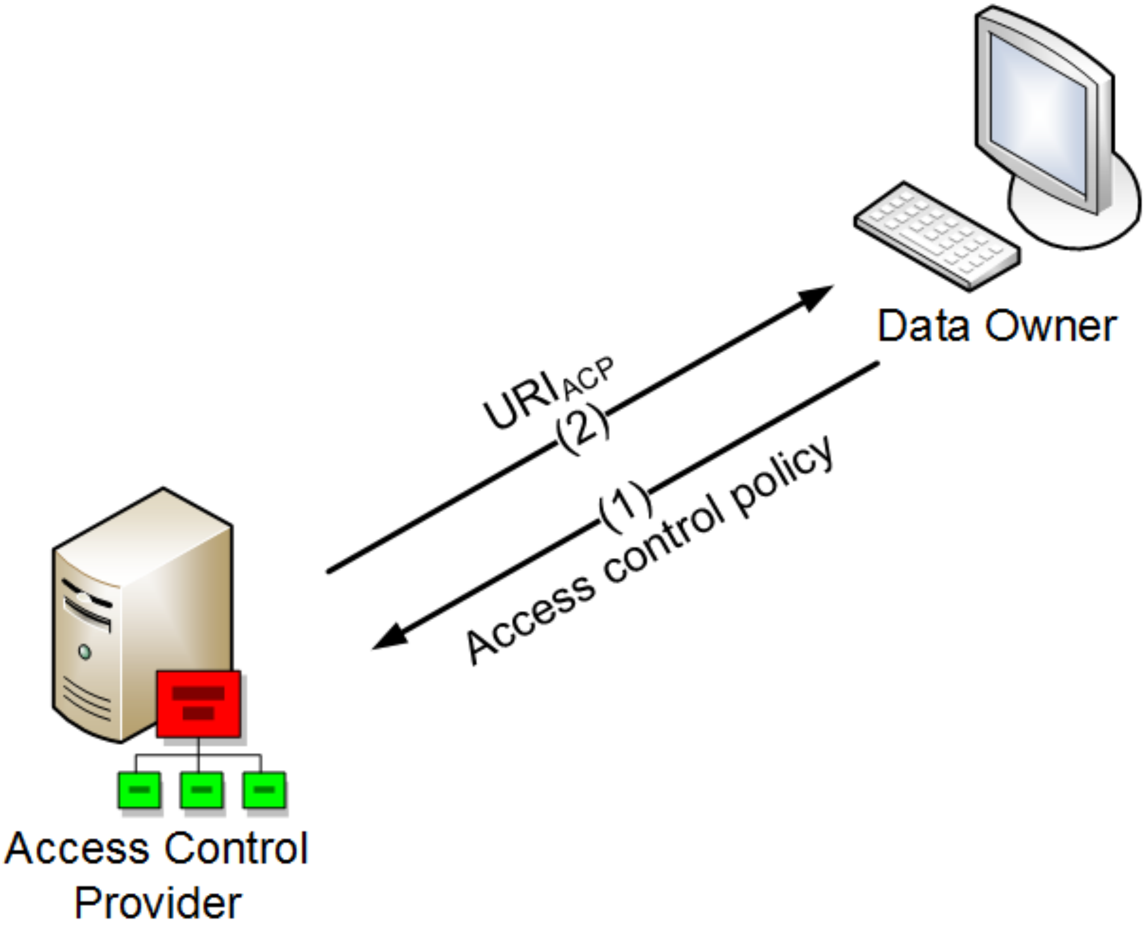
Access Control Provider

Scheme Overview



They may belong to the same physical/ administrative domain

Scheme Overview



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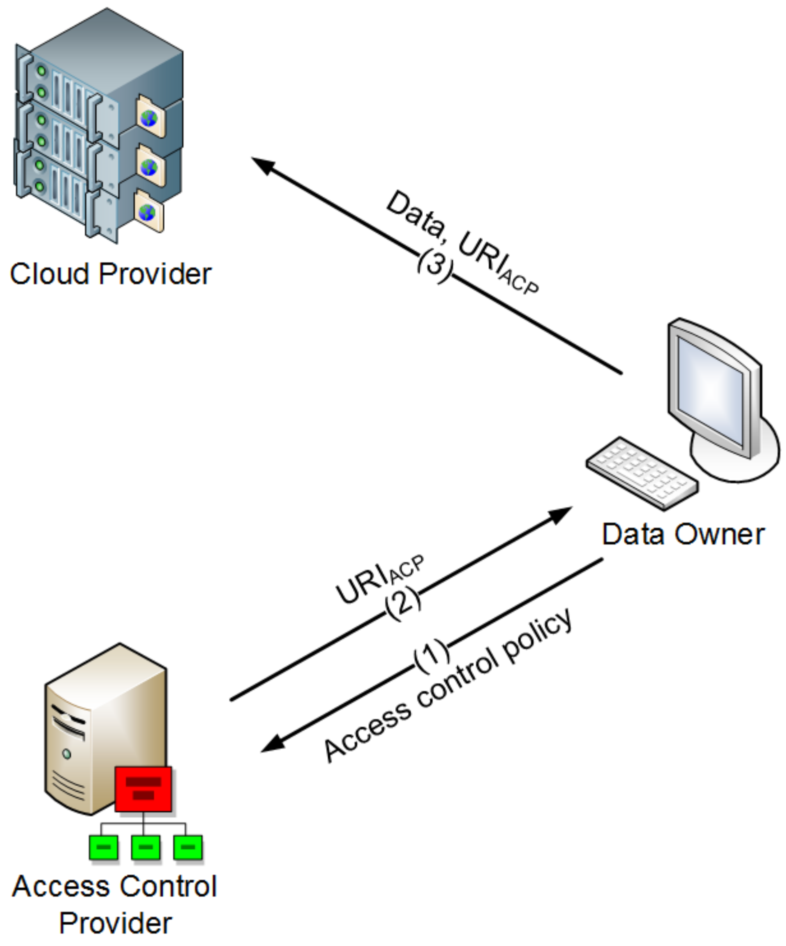

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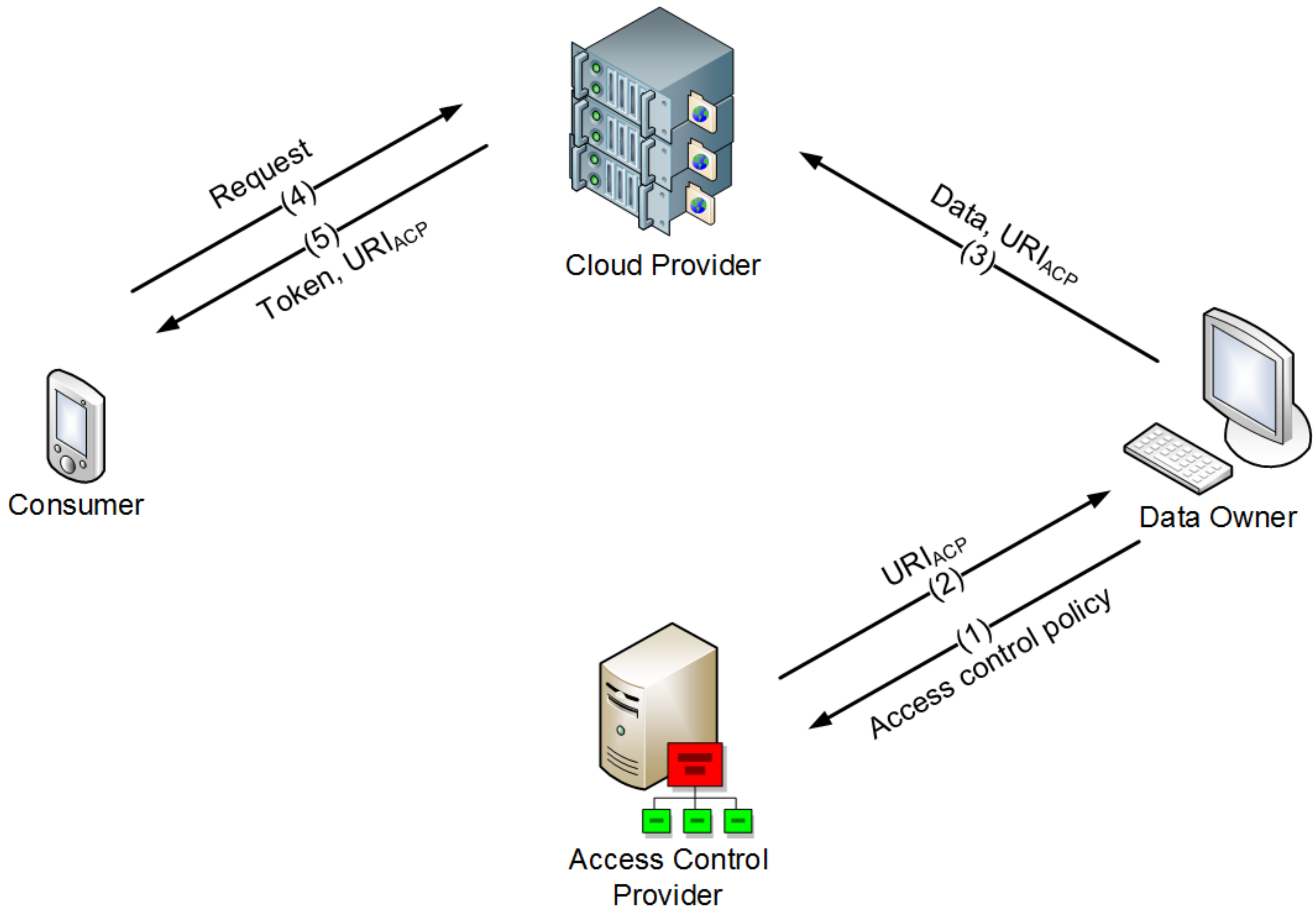

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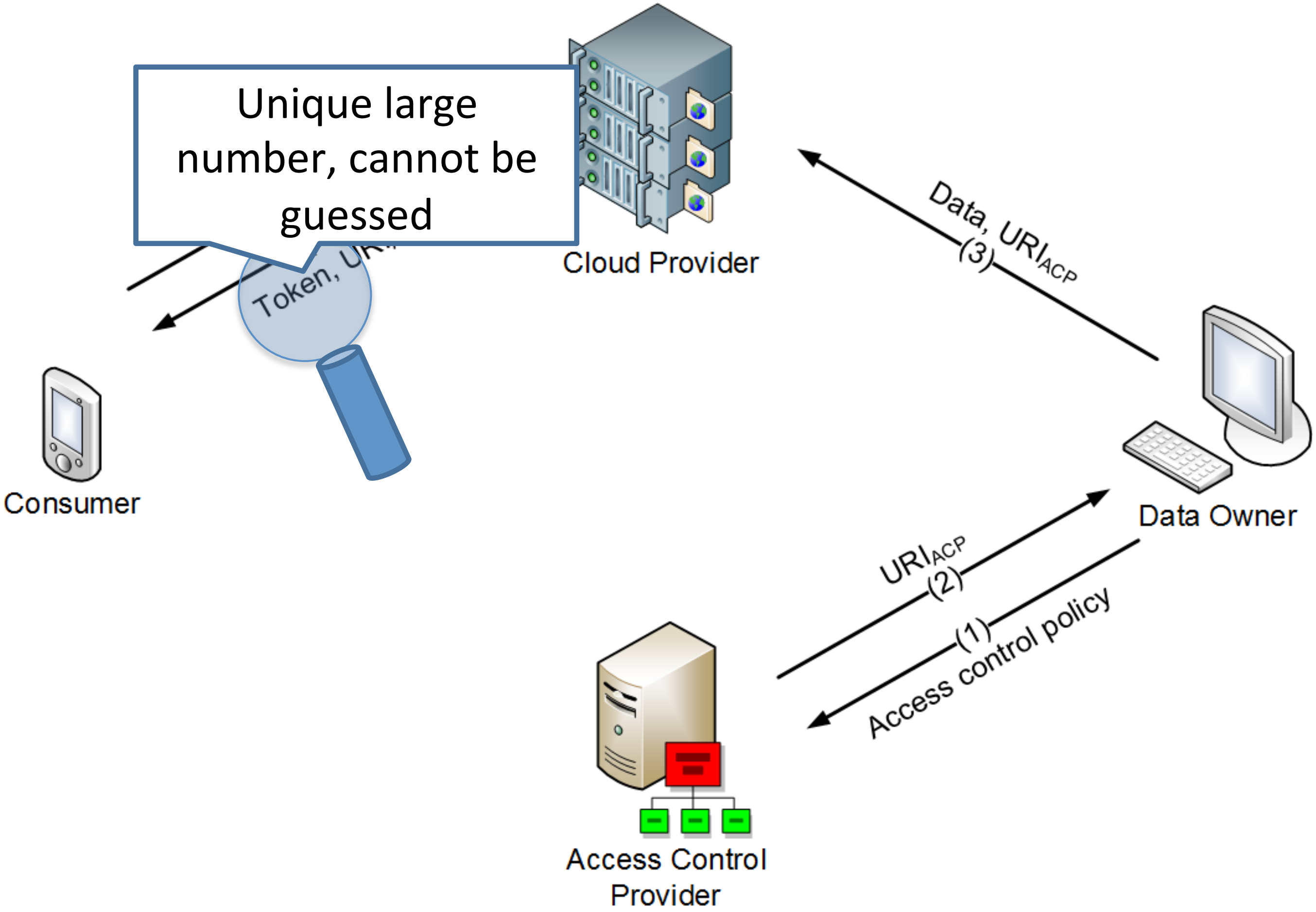
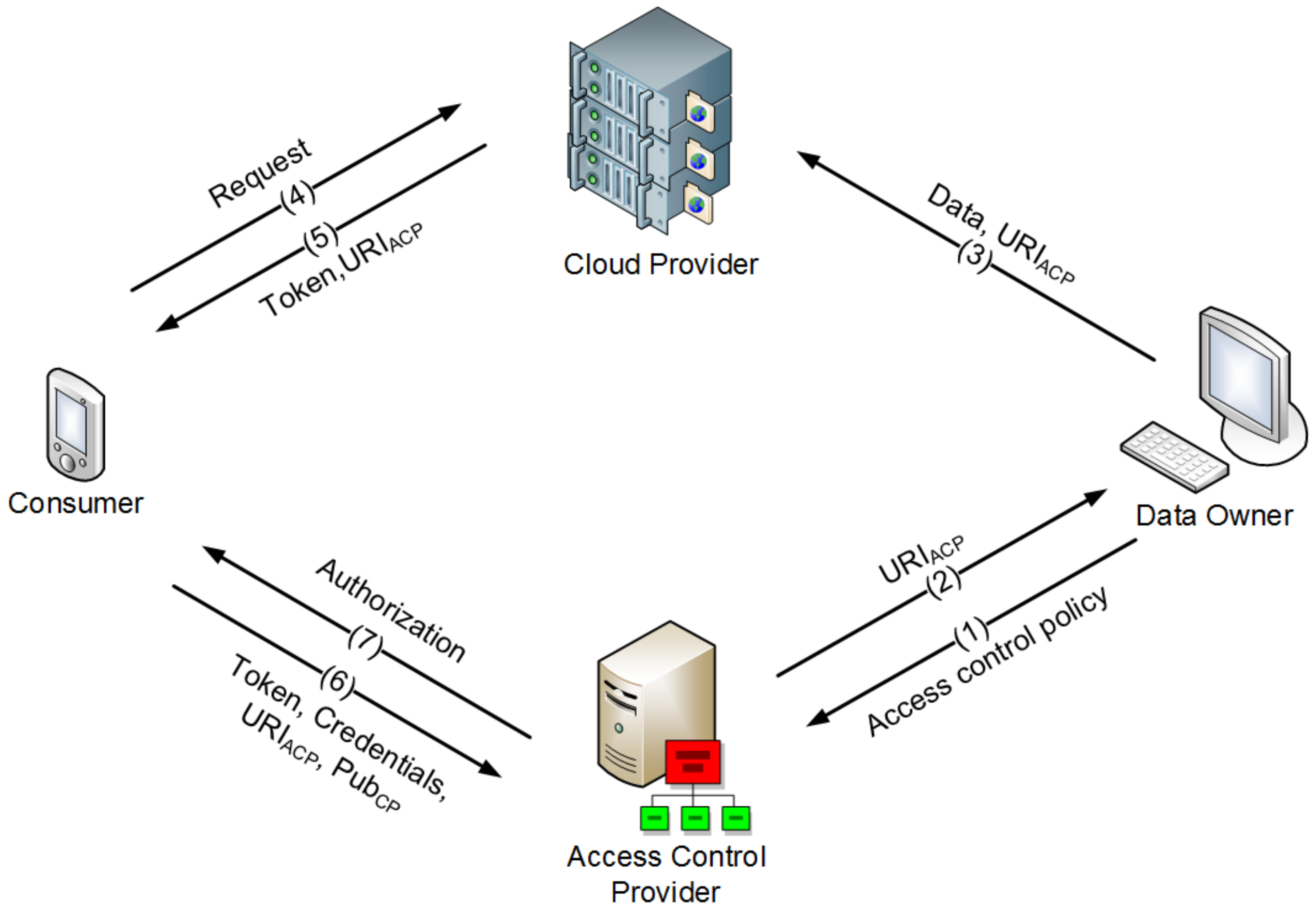


Unique large number, cannot be guessed

Scheme Overview



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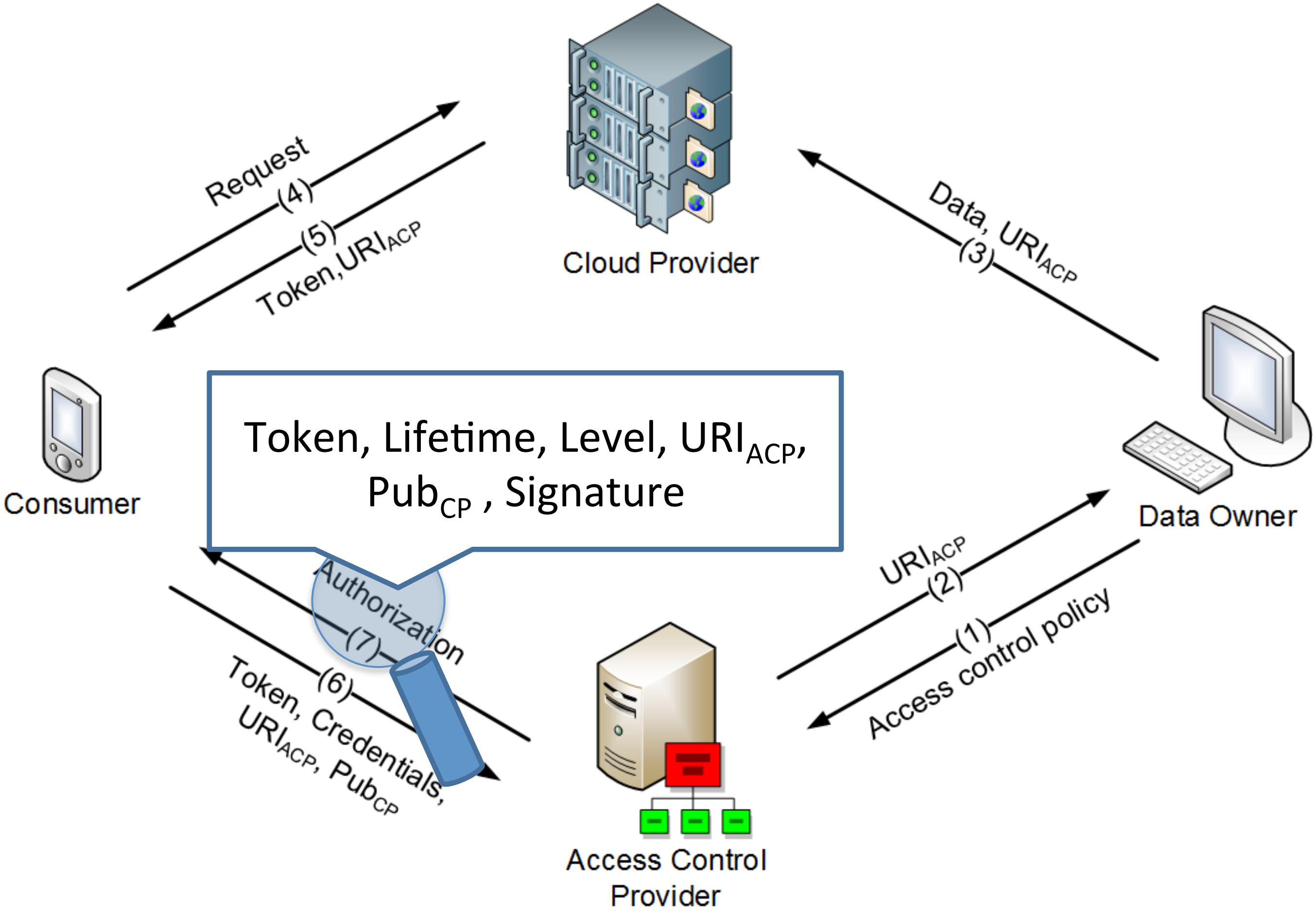
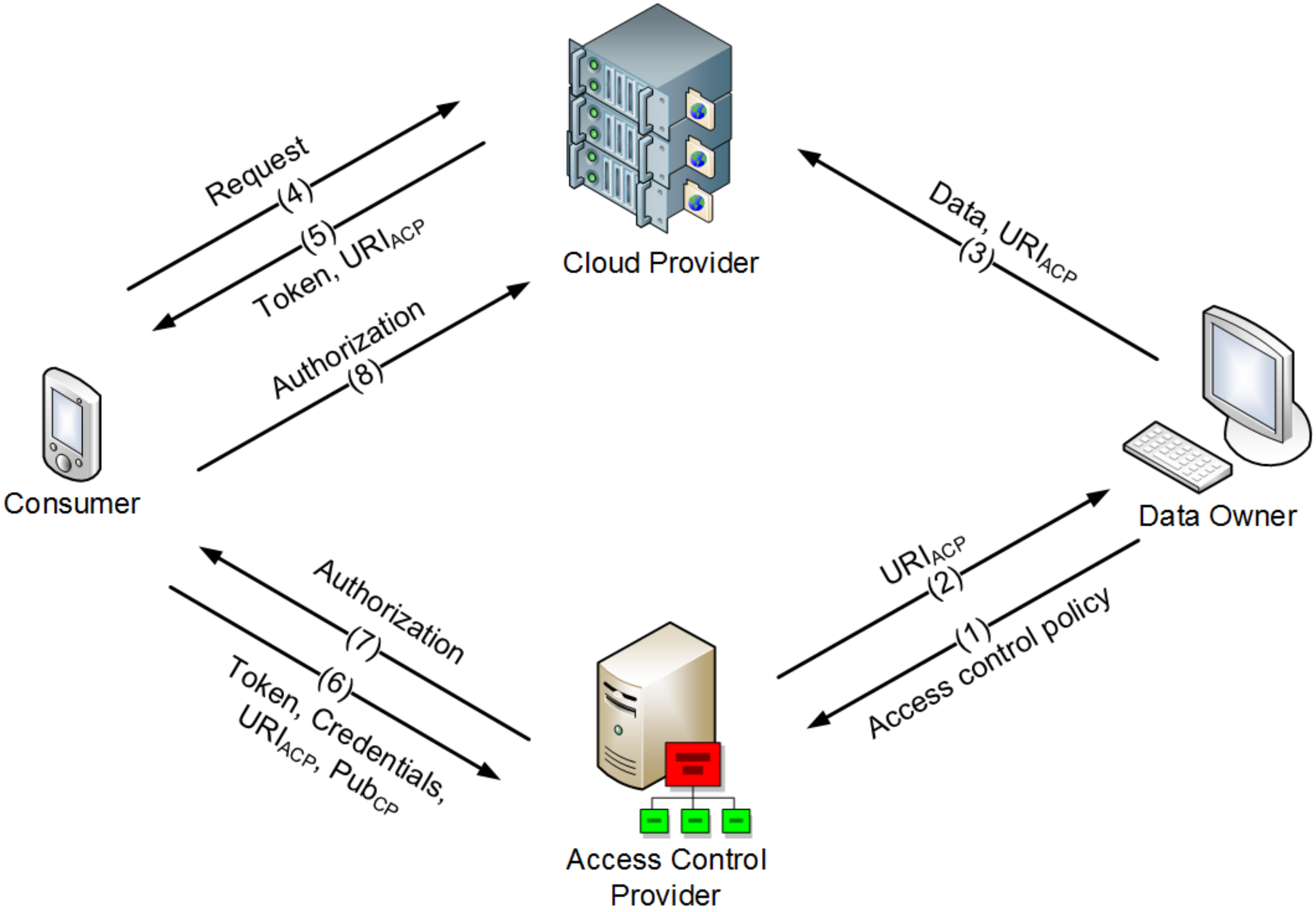


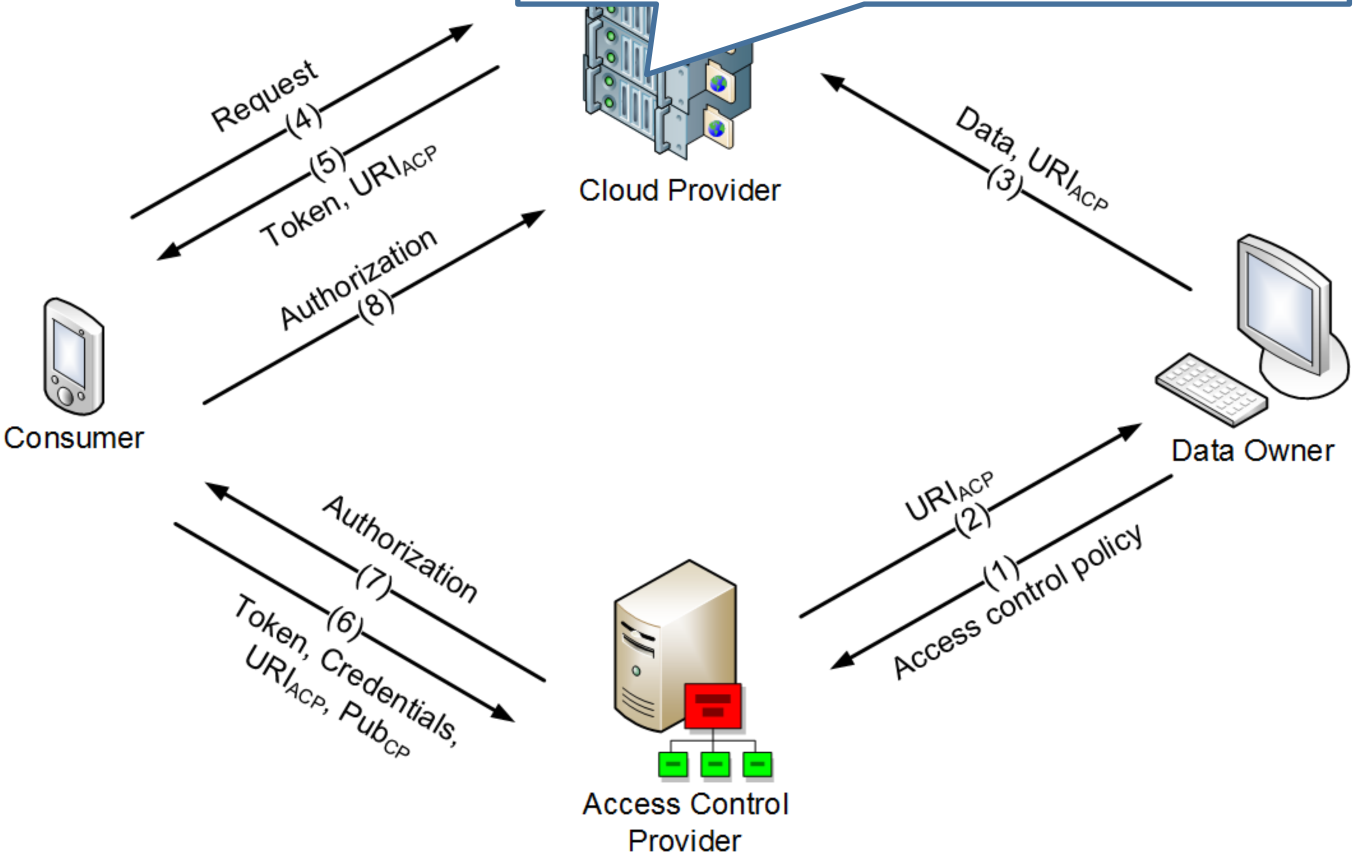
Token, Lifetime, Level, $\mathrm{URI}_{\mathrm{ACP}}$, $\mathrm{Pub}_{\mathrm{CP}}$, Signature

Scheme Overview

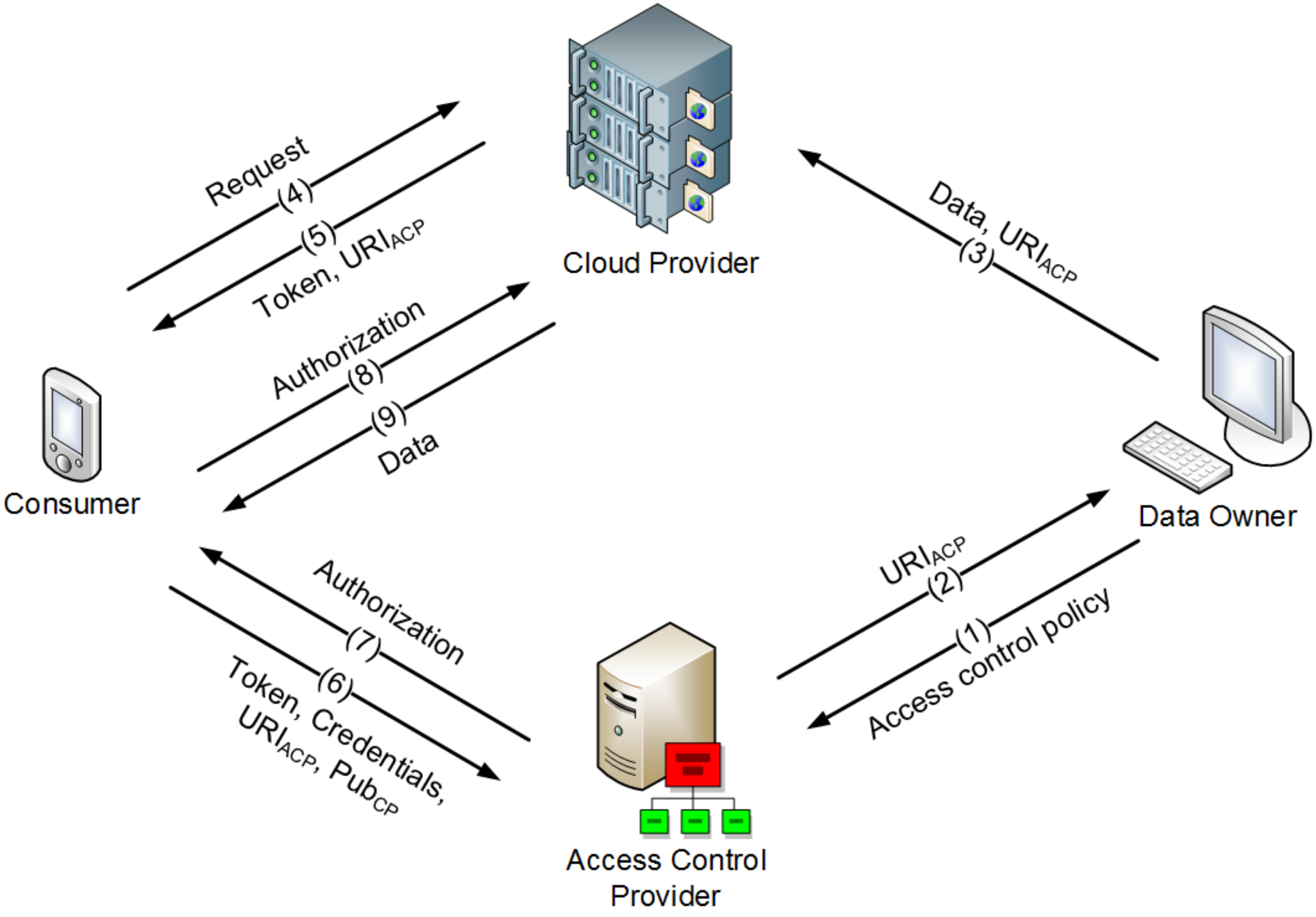


Schen

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



Scheme Overview



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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