dCache.org

dCache and macaroons

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<URL here>

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Introducing Macaroons

Macaroons "cheat-sheet"

- Macaroon is a **bearer token**.
- Macaroon contains zero or more **caveats**.
- Each caveat **limits** something about the macaroon:

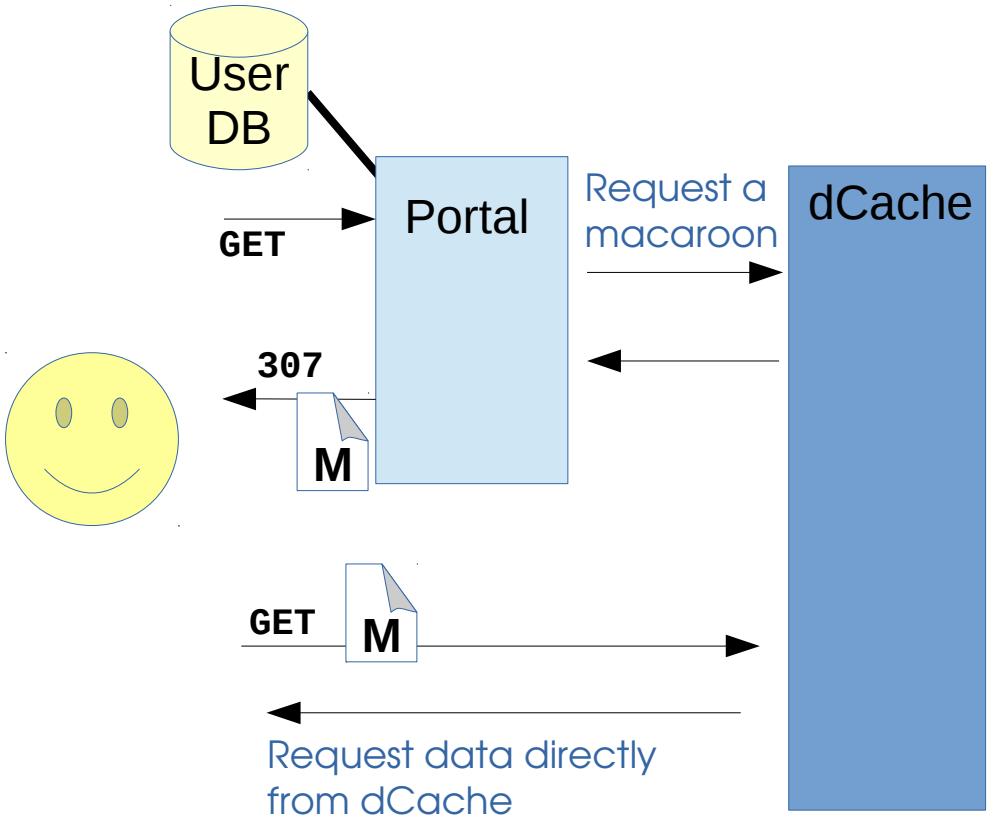
  who can use it,

  when they can use it, or

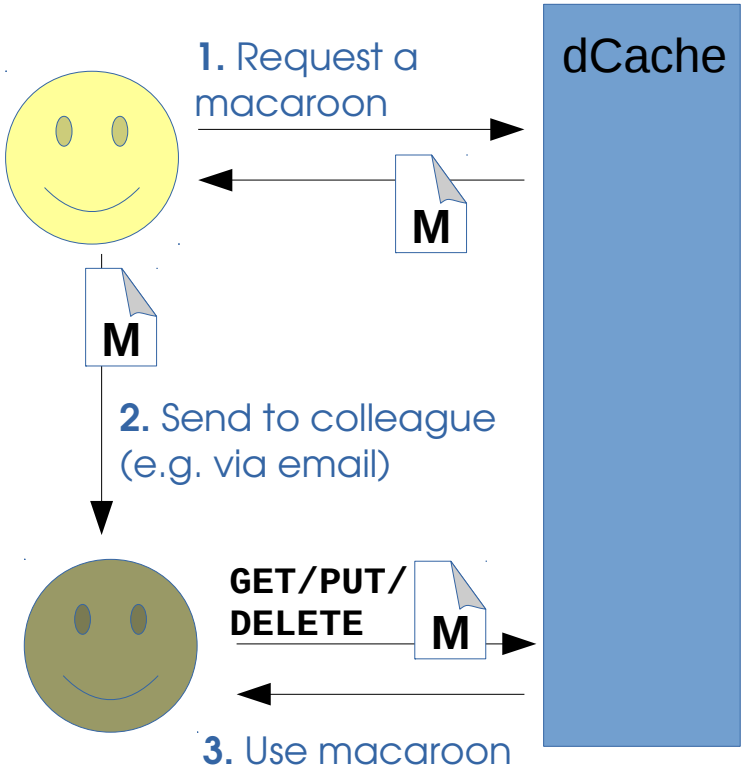
  what they do with it.
- Anyone can **add a caveat** to a macaroon

  … creating a new, more limited macaroon.
- No one can **remove a caveat** from a macaroon

What are macaroons good for?

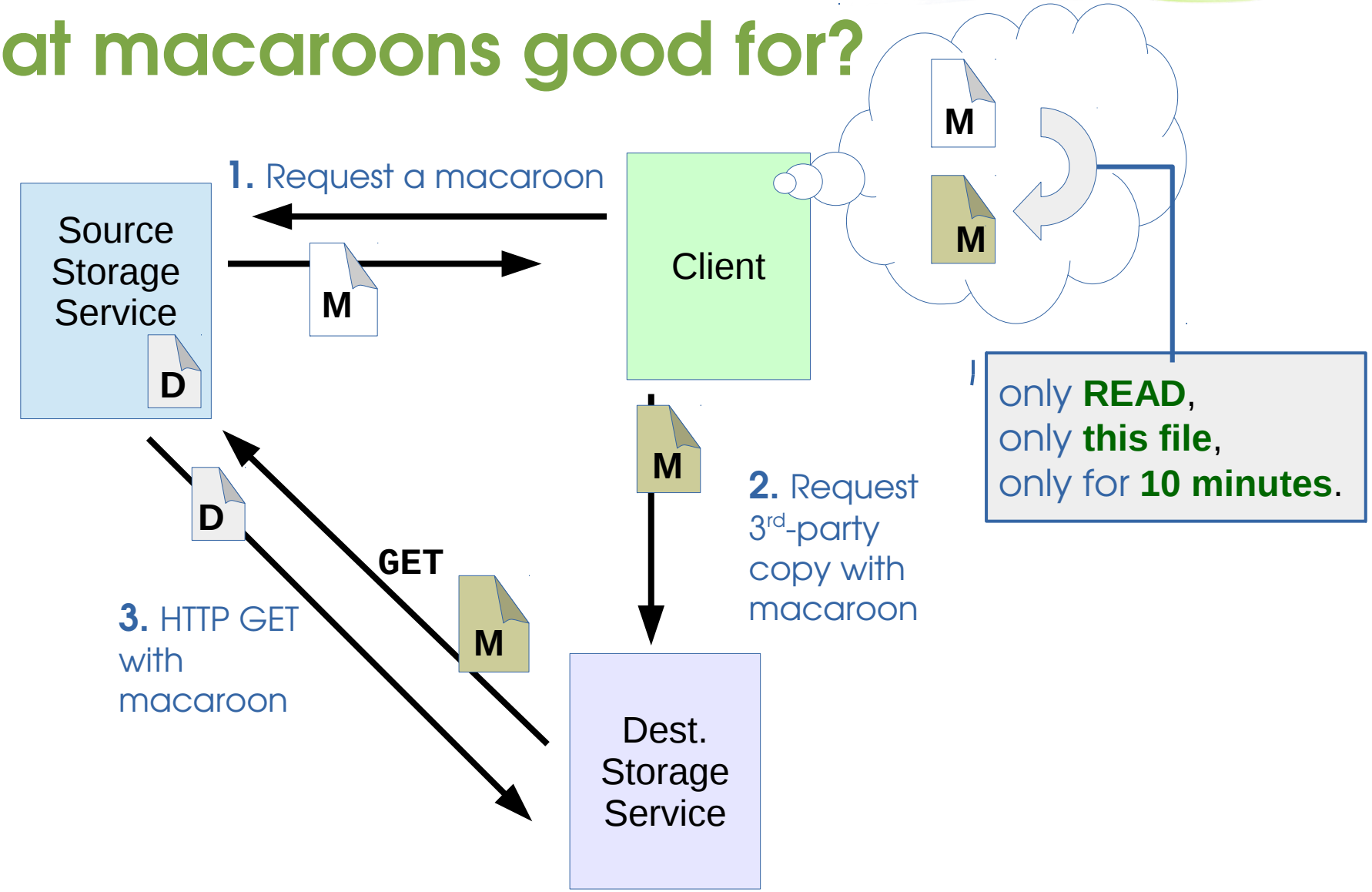


Community Portals



Delegating/Sharing

What macaroons good for?



Authorising third party copies

What macaroons good for?

There are lots more possibilities...

- Hiding authentication mechanism (e.g., X.509) from users
- Centralised authorisation service

...

Macaroons are a **basic building-block** that has many potential uses.

Enough theory, now for dCache ...

Getting a macaroon

- Unfortunately no standard way of doing this … here's how with dCache
- Currently via the **HTTP/WebDAV door**:
- Request is **HTTP POST**:
  - Must be SSL/TLS connection and include HTTP header:

    ```
    Content-Type: application/macaroon-request
    ```

  - Optional request body is JSON object, like:

    ```
    {
      “caveats”: [ “caveat-1”, “caveat-2”, …],
      “validity”: “<validity>”
    }
    ```

    The **“caveats”** and **“validity”** fields are optional.
    JSON object is optional → empty caveats and validity.
- If successful, response is JSON object with **macaroon** item

  ```
  {
    “macaroon”: “MDAwZmxvY2F0a....”
  }
  ```

Using a macaroon

When authenticating **with dCache**:

- Standard HTTP request header:

  `Authorization: BEARER <macaroon>`

- For awkward clients, embed macaroon in the URL:

  `https://webdav.example.org/mydir/file?authz=<macaroon>`

For **3rd party HTTP transfers** (dCache authenticating with remote storage):

- **WebDAV** COPY request, add header:

  `TransferHeaderAuthorization: BEARER <macaroon>`

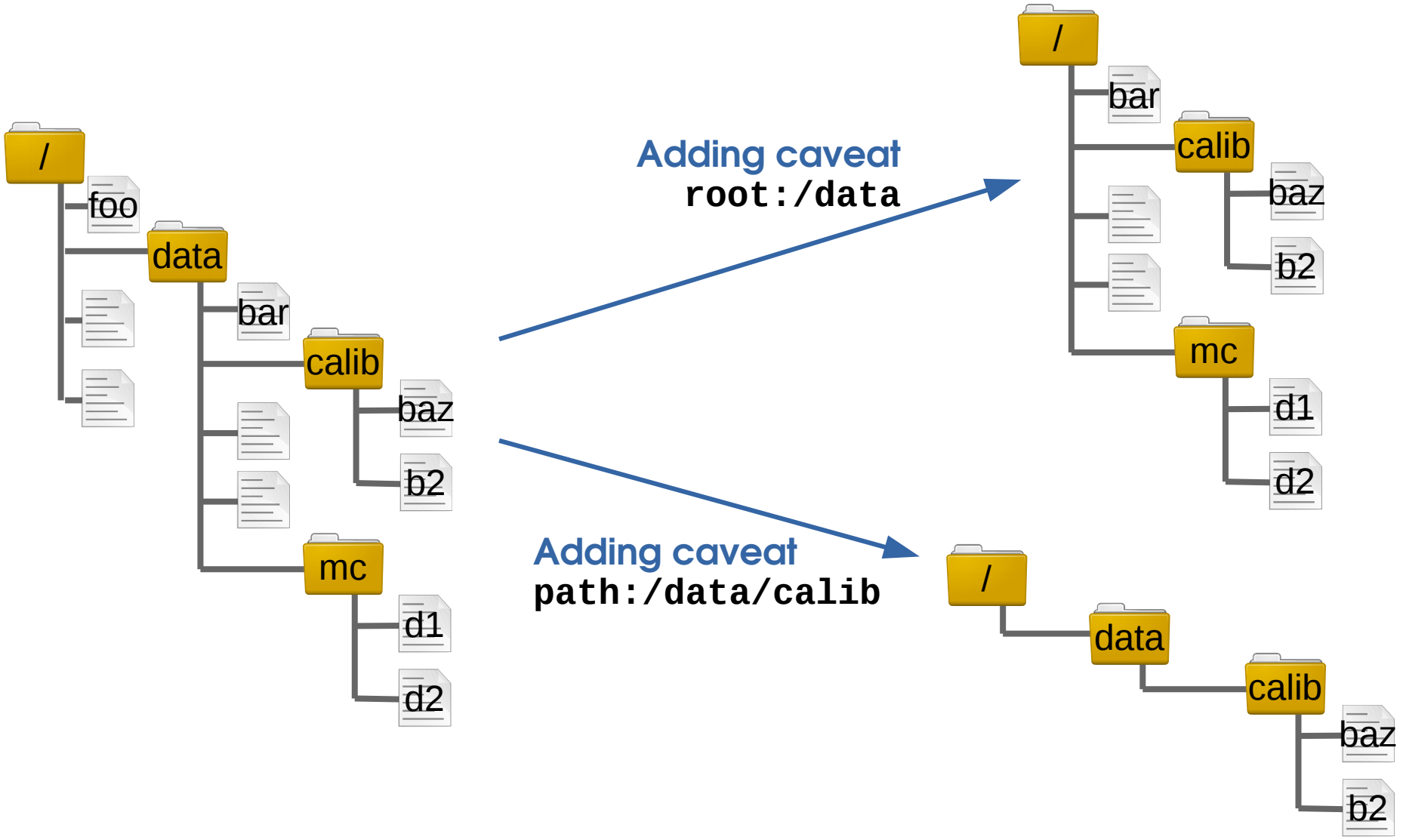
- **SRM** srmCopy requst, include TExtraInfo; e.g.,

  `srmcp "-extraInfo=header-Authorization:BEARER <macaroon>"`

Six caveats supported

- Unfortunately, there are no standard caveats. Here are those that dCache understands:
- Three path caveats:
  - **`root:`**<path> – chroot into this directory,
  - **`home:`**<path> – the user's home directory (not currently used),
  - **`path:`**<path> – only show this path.
- Two context caveats:
  - **`before:`**<timestamp> – when macaroon expires,
  - **`ip:`**<netmask list> – reduce which clients can use macaroon.
- One permissions caveat:
  - **`activity:`**<comma-list> – what operations are allowed.

How path caveats affect namespace



Time caveat – expiring macaroon

`before:<timestamp>`

where **`<timestamp>`** is **ISO 8601 UTC time**;
e.g, **`before:2017-05-29T16:00:00Z`**

- Once time has elapsed, macaroon is useless.
- Validity can be reduced by adding more **`before:`** caveats.
- Short-cut: use the **`validity`** value in JSON request.

  Calculates and adds a corresponding **`before:`** caveat.

  The value is **ISO 8601 duration**; e.g., **`PT3S`** for 3 seconds.

  Request JSON like **`{"validity"="PT1M"}`** returns a macaroon valid for 1 minute.

Client IP caveat – limit who can use it

`ip:<netmask-list>`

where **`<netmask-list>`** is a comma-separated list of subnets or addresses; e.g.,

```
ip:198.51.100.42,2001:db8:85a3::8a2:37:733, ↵
   192.0.2.0/24,2001:db8:cafe::/48
```

- Client's IP address must match (at least) one of the **`ip:`** caveat's **`<netmask-list>`**.
- Adding more **`ip:`** caveats allows further restriction; e.g.,

`ip:198.51.100.0/24`	restrict to campus subnet
`ip:198.51.100.28`	only a specific machine

- No **`ip:`** caveats means all clients may use the macaroon.

Activity caveats – limited what is allowed

`activity:<activity-list>`

where **`<activity-list>`** is a comma-separated list of allowed activities; e.g.,

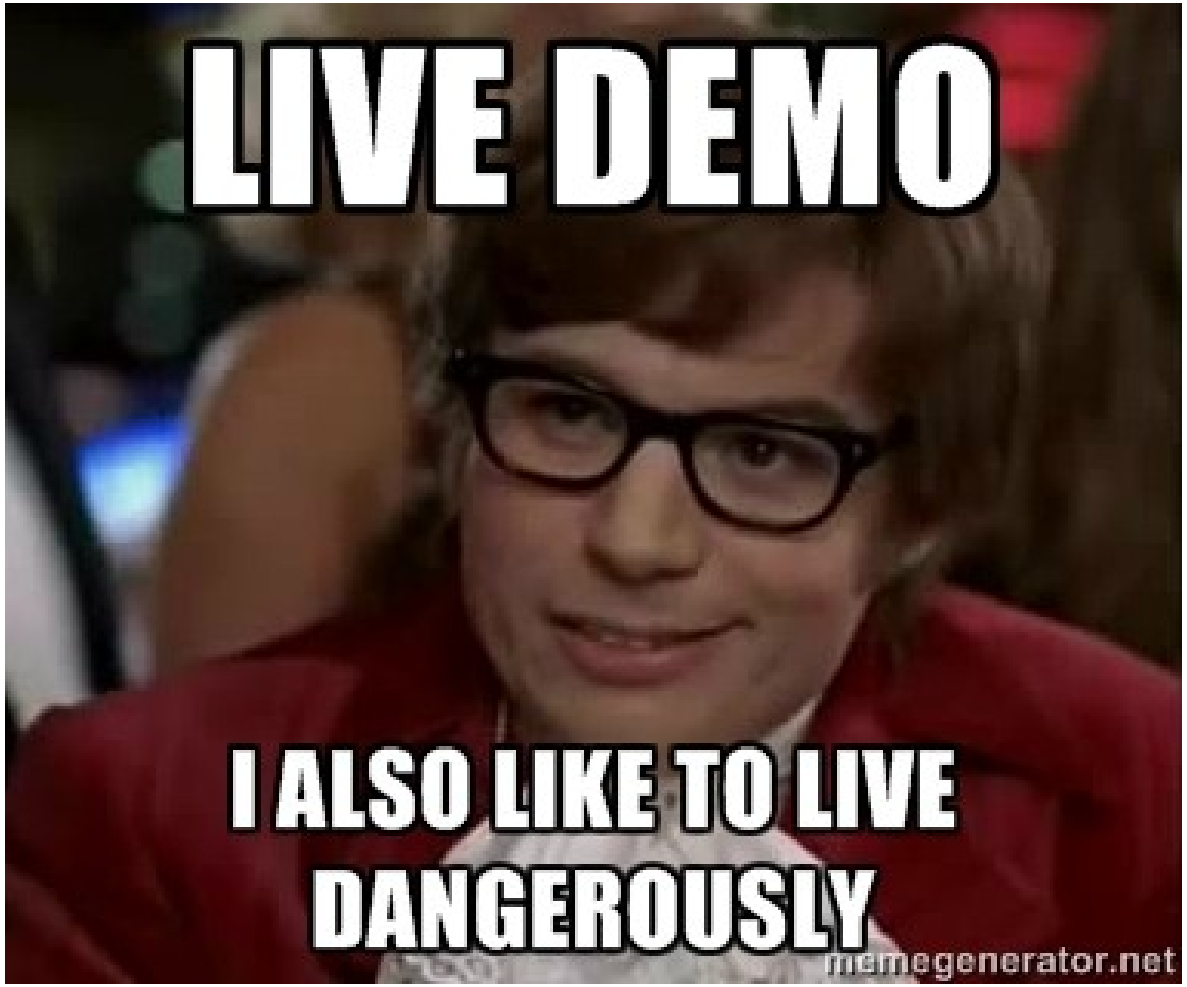
`activity:DOWNLOAD,LIST`

- Possible activities are:

  `DOWNLOAD`, **`UPLOAD`**, **`DELETE`**, **`MANAGE`**, **`LIST`**, **`READ_METADATA`**, **`UPDATE_METADATA`**.

- Allowed activity may be further reduced by adding more **`activity:`** caveats.

  No **`activity:`** caveat means client can do whatever the user requesting the macaroon can do.


LIVE DEMO
I ALSO LIKE TO LIVE DANGEROUSLY
memegenerator.net

Demo

- Show curl can upload and download files.
- Show web-browser can see whole namespace.
- Create an unrestricted macaroon.
- Show curl upload/download and web-browser work with macaroon.
- New macaroon with caveats:
  `activity:DOWNLOAD,LIST`
  `path:/path/to/myfile`
  `“validity”:“PT5M”`
- Share modified macaroon with audience as QR code.
- Browse in web-browser with macaroon; use curl to show download works, upload doesn't.
- Wait for timeout.
- Show macaroon doesn't work any more (ask audience to verify)

Backup slides

Combining caveats: namespace

- The root caveats and path caveats combine to create a more restricted caveat:

```
root:/foo
root:/bar
```

equivalent to

```
root:/foo/bar
```

- The **path** and **home** caveats are relative to the effective root when declared:

```
home:/foo/bar/home
root:/foo
path:/bar/baz
root:/bar
```

equivalent to

```
root:/foo/bar
home:/home
path:/baz
```

- Adding **root:** outside an existing **path:** results in a non-functioning macaroon.
- Multiple **home:** caveats have last-one-wins.

Demo #2: root and path

- Show dCache has several directories with content.
- Create read-only macaroon

  Browser dCache name-space with this macaroon
- New macaroon with **`root:/path-1`** caveat.

  Browser dCache name-space
- New macaroon with **`path:/path-1/path-2/myfile`** caveat

  Show only **`/path-1/path-2/myfile`** is visible.
- New macaroon from previous, with **`root:/path-1`**

Demo #3: expiry time

- Show dCache has several directories with content.
- Create macaroon with **`path:/path/to/file`** caveat with expiry time five minutes in the future.
- Create a count-down timer window for when macaroon expires
- Show dCache can read the file OK.
- Create a QR code and share it with the audience.
- Ask audience to try to view the picture.
- Continue talking until window times out.
- When macaroon expires, show file cannot be read

Activity caveat – limit what can be done

- Format:

  `activity:<activities>`

  where **`<activities>`** is a comma-separated list: one or more of **`LIST`**, **`DOWNLOAD`**, **`MANAGE`**, **`UPLOAD`**, **`DELETE`**, **`READ_METADATA`**, **`UPDATE_METADATA`**.

- No caveat is the same as all activities:
  `activity:LIST,DOWNLOAD,MANAGE,UPLOAD,DELETE,READ_METADATA,UPDATE_METADATA`

- Multiple caveats are allowed,

  Subsequent caveats must be a subset of earlier caveats.

Root caveat – a bit like 'chroot'

- Format:

  `root:<path>`

- No root caveat is the same as **`root:/`**
- User sees only files and directories under this path.
- Multiple caveats are allowed,

  Subsequent caveats are resolved relative to the previous caveat. Must not be inconsistent with any path caveat.

Home caveat – an initial directory

- Format:

  `home:<path>`

- No home caveat is the same as **`home:/`**
- How this is used is protocol and client specific
- Multiple caveats are allowed,

  Caveats are resolved relative to the current root.
  Value is automatically updated after a root caveat.

Path caveat – specific target

- Format:

  `path:<path>`

- No home caveat is the same as **`path:/`**
- The paths of files and directories are unaffected, but only directories leading up to **`<path>`** or have **`<path>`** as a prefix are visible.

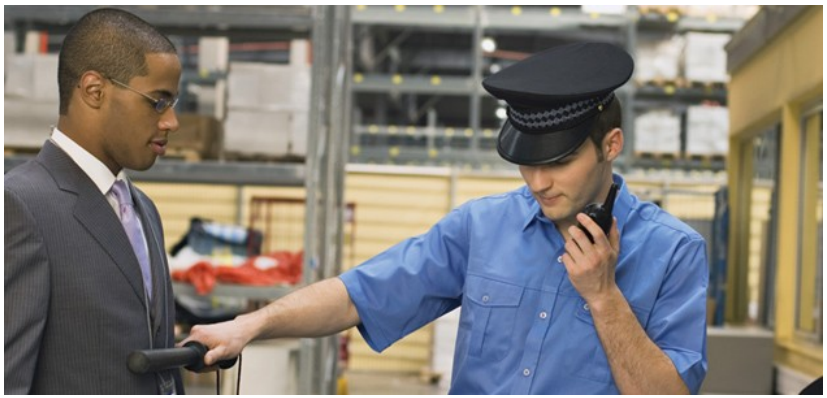
  You don't want to change the URL, but only allow access to this URL.

- Multiple caveats are allowed,

  Caveats are resolved relative to the current path.

Quick recap

Authn

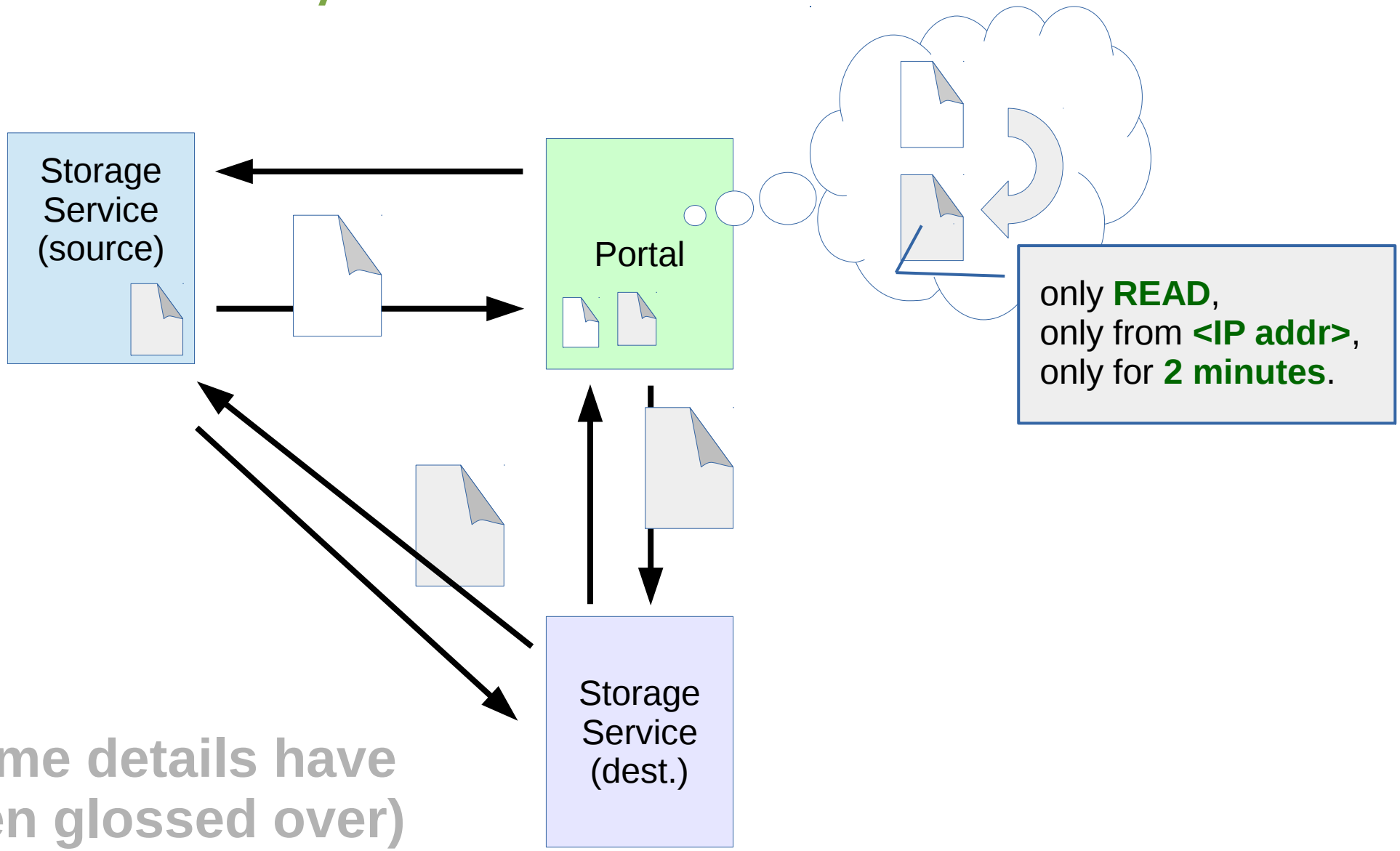


Authz

Authorisation without authentication?

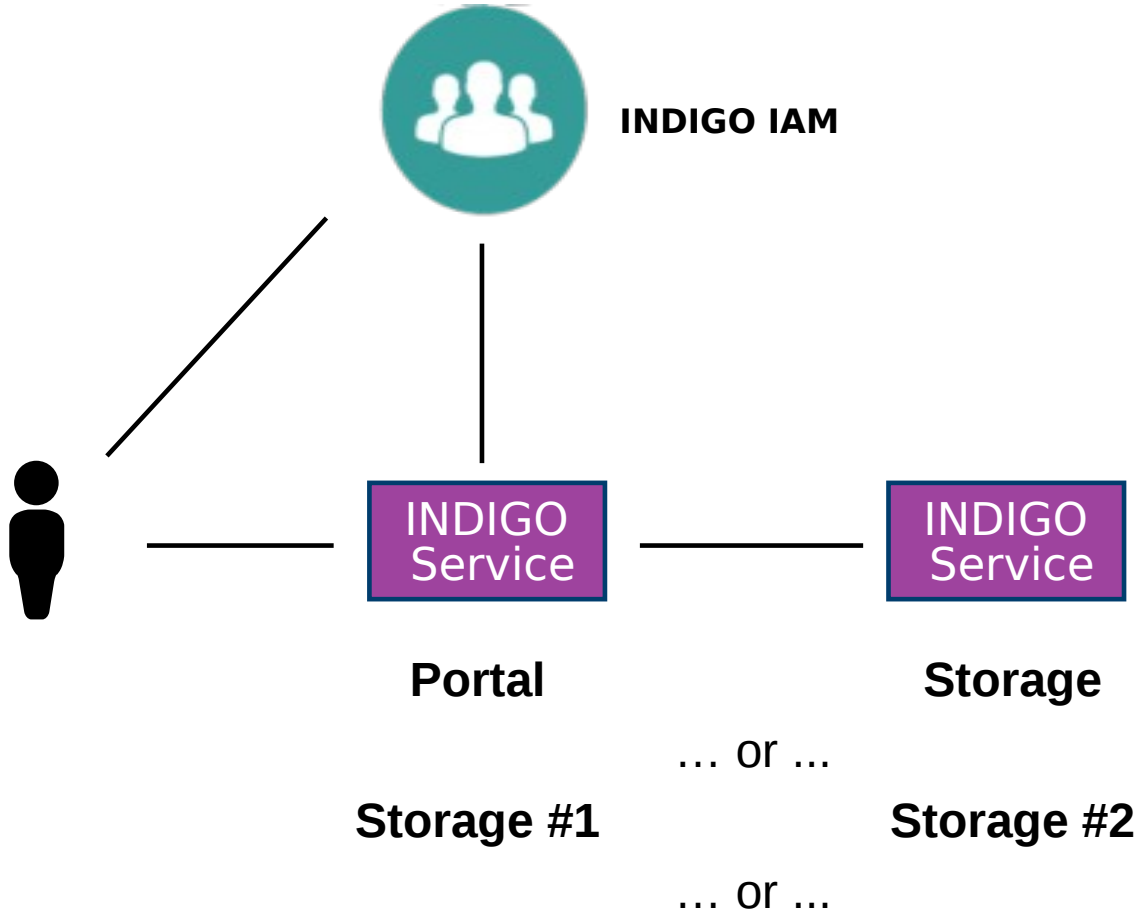
Photo by Alan Cleaver (CC-BY)

Download / Share with macaroons



(some details have been glossed over)

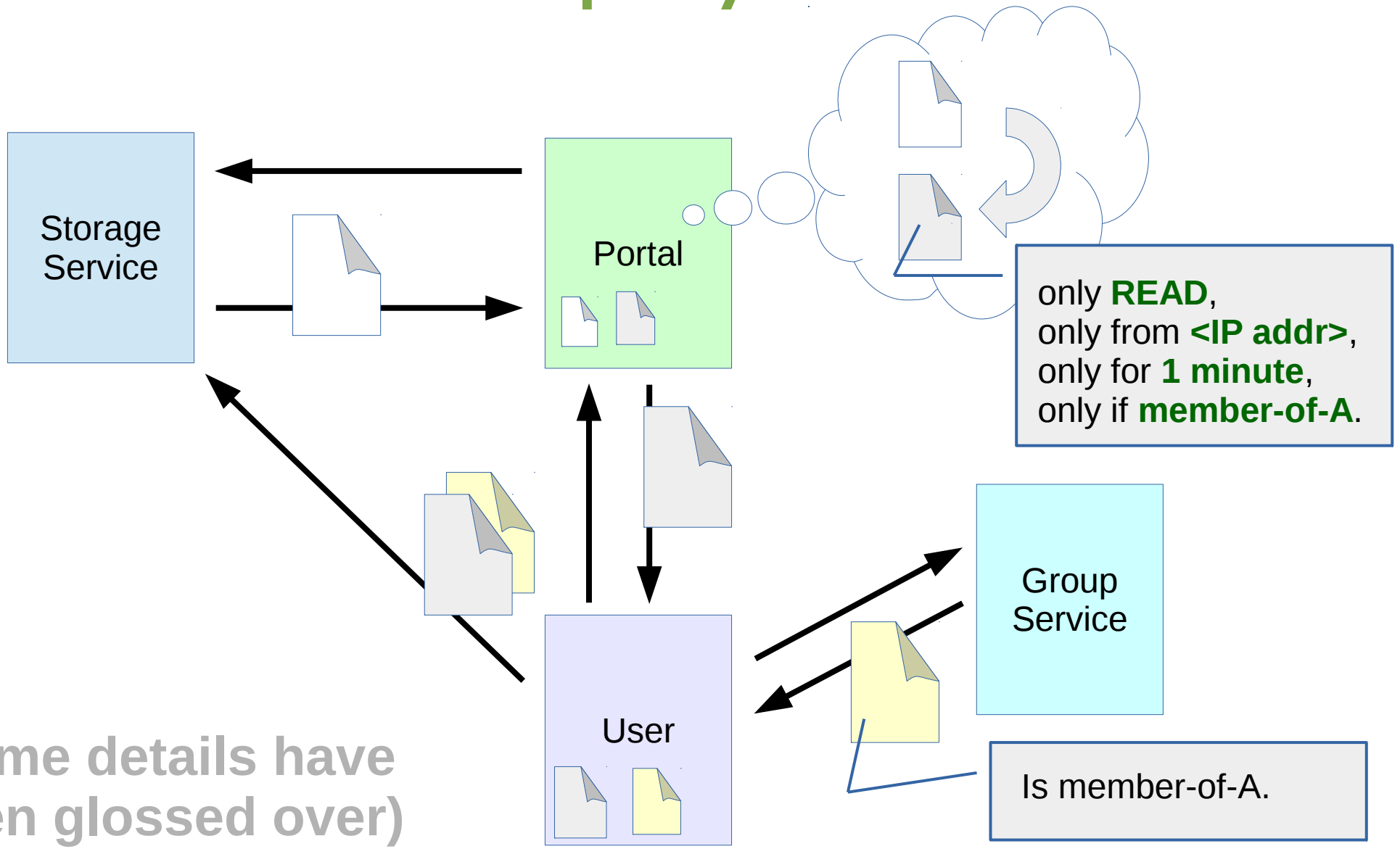
OpenID Connect delegation



3rd party caveats – extra cool!

- A 1st party caveat can be satisfied by the client.
- A 3rd party caveat requires proof from some other service; e.g.
  - only **fred@facebook**,
  - only members of **VO ATLAS**,
  - only if not part of a **denial-of-service attack**.
- The proof is another macaroon: a **discharge macaroon**.

Download with 3rd-party caveat



(some details have been glossed over)

What are bearer tokens?

Bearer token is something the user presents with a request so the server will authorise it. There's no interaction between client and server.

Examples of bearer tokens:

HTTP BASIC authn, anything stored as a cookies.

Counter-examples:

- X.509 credential,
- SAML,
- Kerberos.

Group membership, too

- An OIDC provider can assert the user is a member of various groups
- Group membership may require higher level of LoA:

  For example, if the group is "loose collaboration" a site might require higher LoA; if the group is "commercial entity" a site might require lower LoA

One solution: a bearer token