XAuth

IETF 108 - GNAP WG
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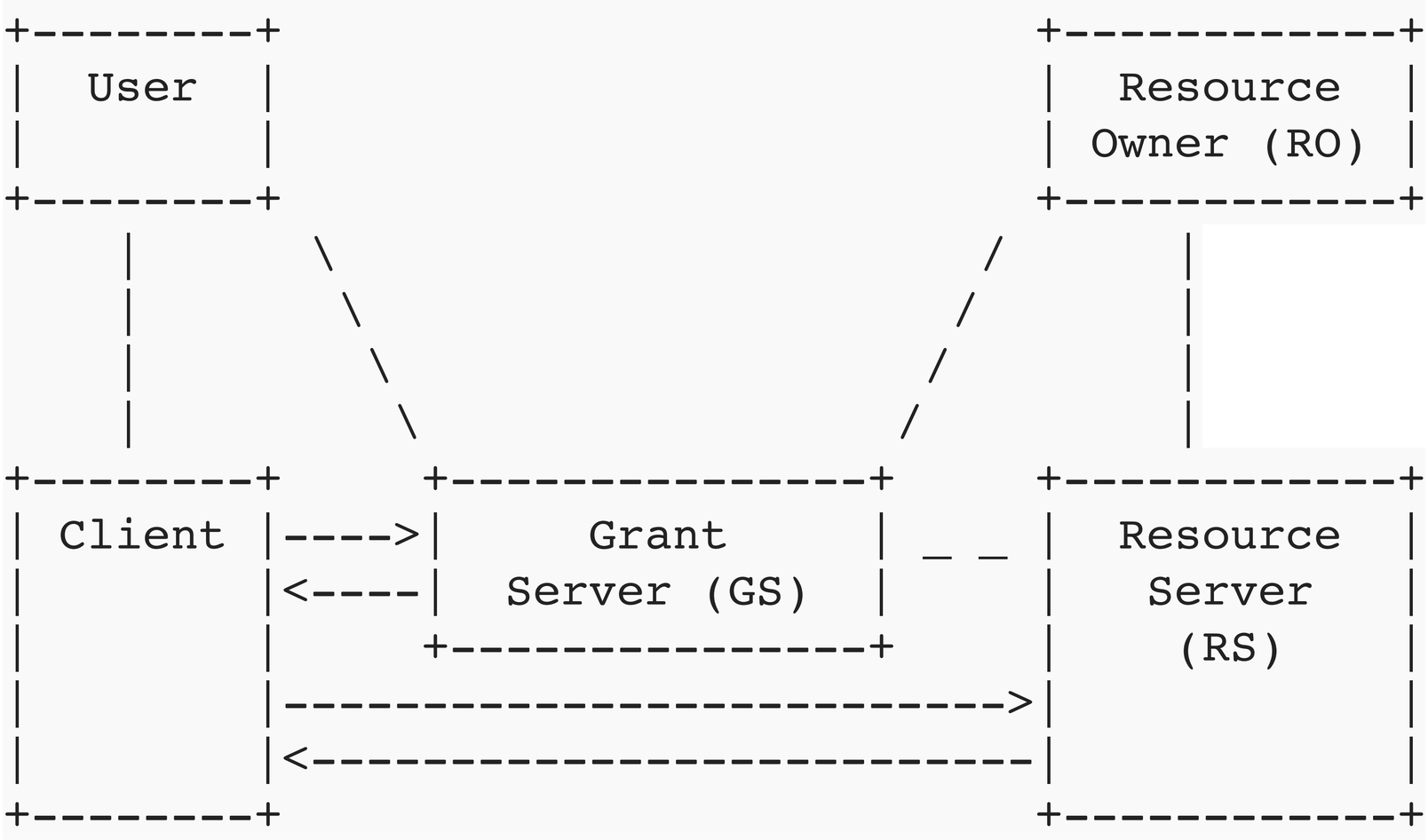
Overview

- **XAuth Intro**
- **XAuth Goals**
- **Key XAuth Features**
- **Implementation Learnings**
- **draft-hardt-xauth-protocol-13 (latest) vs -06 (IETF 107)**
- **Open Items**

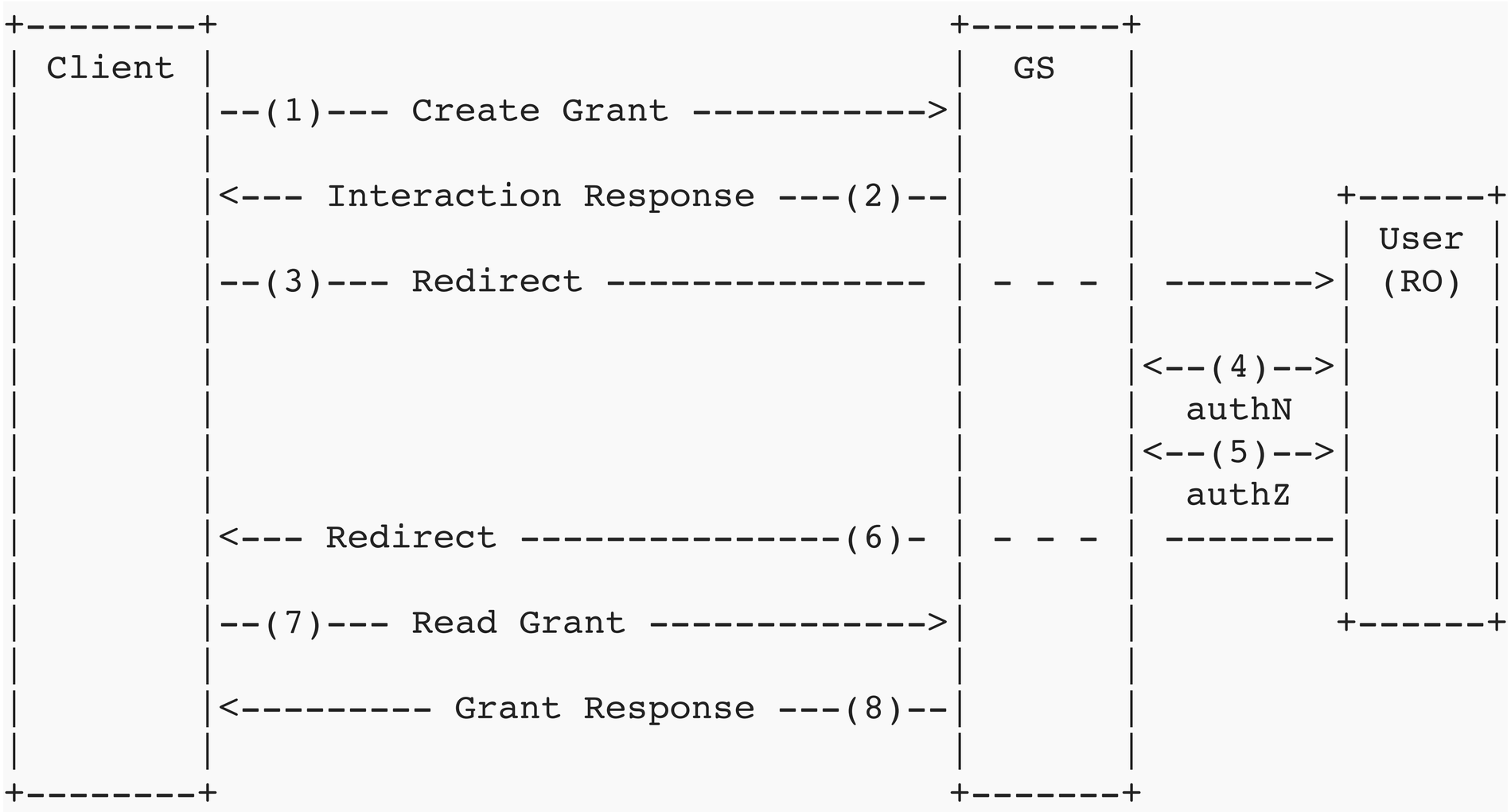
Parties


User
Resource Owner (RO)
Client
Grant Server (GS)
Resource Server (RS)

Key Terms

- **Claims** - statements about the User
- **Authorizations** - Client access to a RS
- **Grant** - Collection of authorizations and/or claims issued by Grant Server (GS)
- **GS** - OAuth Authorization Server (**AS**) & OpenID Connect **OP** (OpenID Provider)
- **Interaction** - how User is directed to interact with the GS to authorize a Grant

General Sequence



XAuth GS API URI Examples

- **GS URI** `https://gs.example/endpoint`
- **Grant URI** `https://gs.example/endpoint/grant/8e3a6354...`
- **AZ URI** `https://gs.example/endpoint/authz/fad923b4...`

XAuth Goals

- **Extensible** - well defined extension points
- **Migration** - from OAuth 2.0 and OpenID Connect
- **Reuse** - build on what has come before
- **Scalable** - decomposable architecture, separation of concerns
- **Simple** - simple things are simple
- **Flexible** - hard things are possible

Extensible

- User
- Client
- Interactions
- Authorizations
- Claims
- New Objects
- Client AuthN

```
{
    "user": {
        "identifiers":{...}, "claims":{...},
        "new_user_property":{...}
    },
    "client":{
        "id": "client_1", "display":{...}, "handle": "f6a60810-3d07",
        "new_client_property":{...}
    },
    "interaction":{ "redirect":{...}, "indirect":{...}, "user_code":{...},
        "new_interaction_mode":{...}
    },
    "authorizations":{
        "token_1":{ "type": "oauth", "scope": "read write" },
        "token_2":{
            "type": "new_RAR_type",
            "label": "value"
        }
    },
    "claims" :{ "oidc":{...}, "vc":{...},
        "new_claim_type":{...}
    },
    "new_top_level_object":{...}
}
```

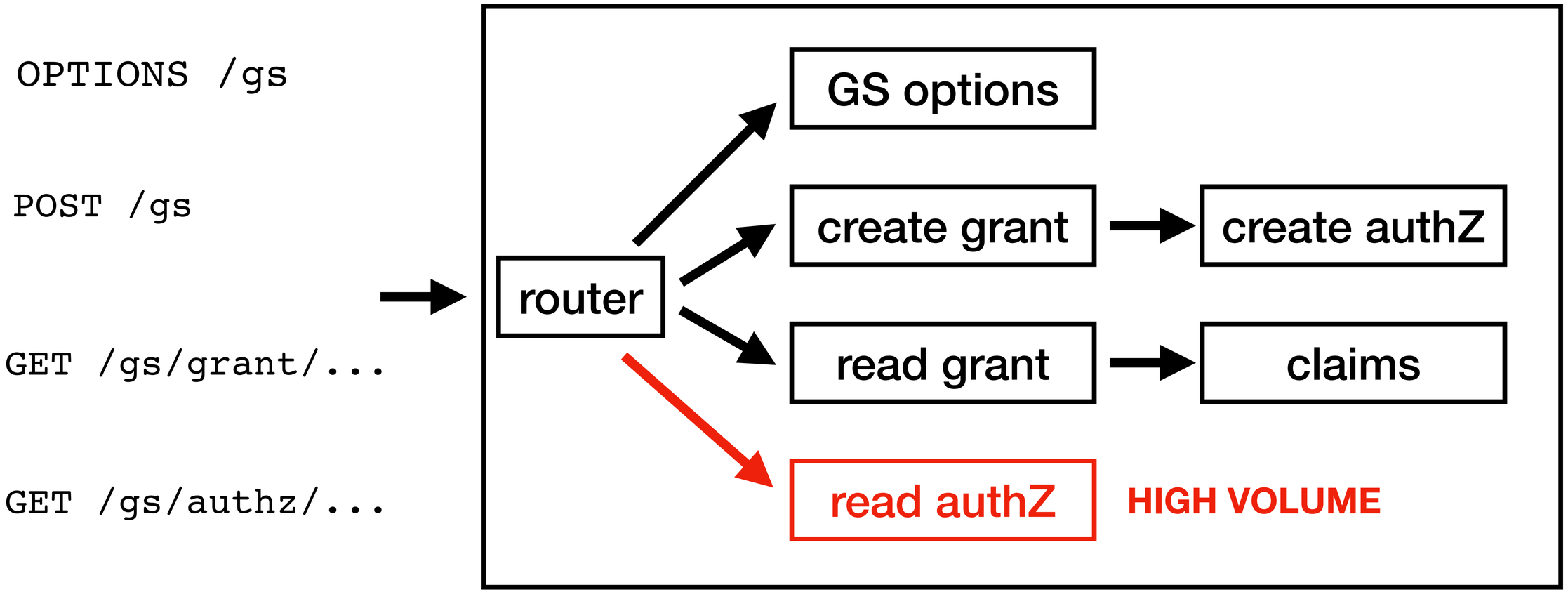
OAuth/OIDC Migration

```
"client": {
    "id": <existing client id>
    },
"authorizations": {
   "type": "oauth_scope",
   "scope": <existing oauth scopes>
   },
"claims": { "oidc": {
   "userinfo" : { <OIDC claims> },
   "id_token" : { <OIDC claims> }
   }
}
```

Reuse

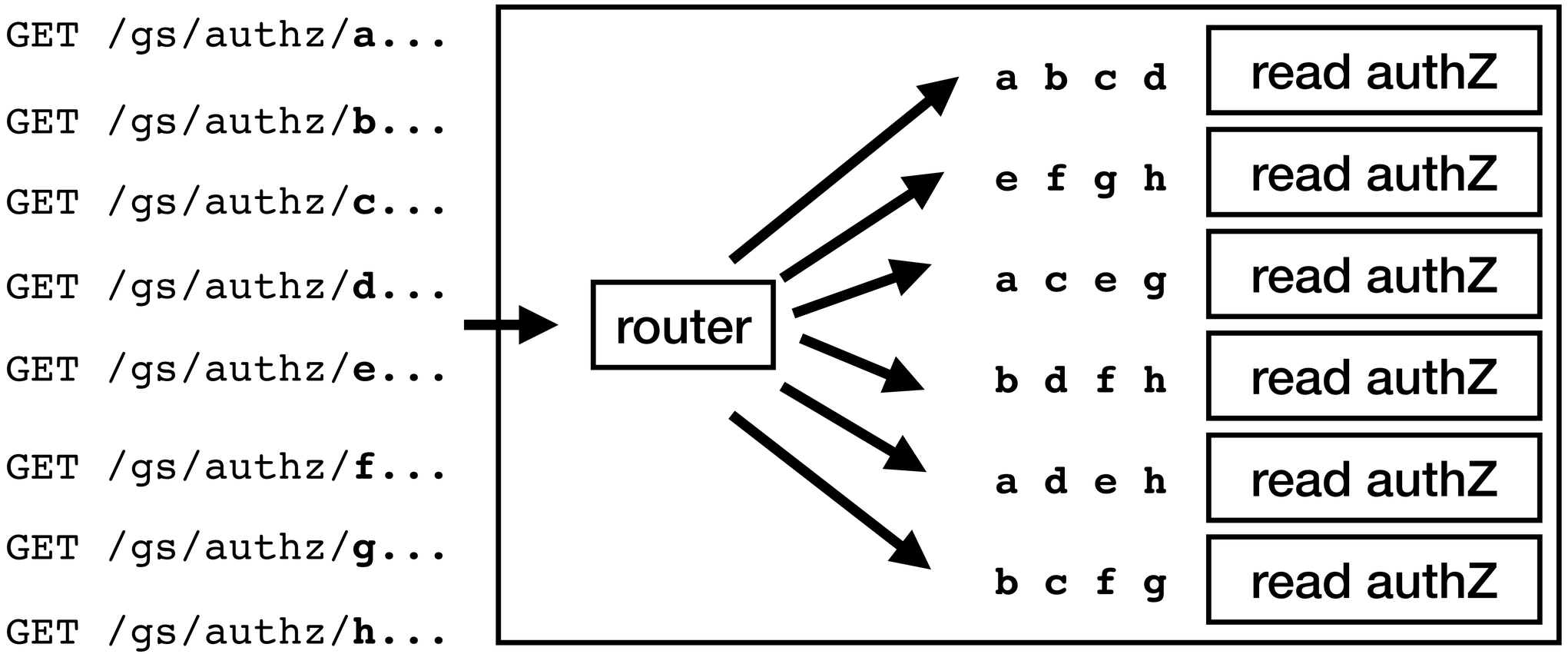
- JSON, TLS, HTTP
- HTTP verbs for RESTful API
- OAuth 2.0: client_id, scopes, access tokens
- OpenID Connect: client_id and claims
- OAuth Rich Authorization Request (RAR)
- JOSE for Client AuthN

Decomposed Grant Server



Shuffle Sharding

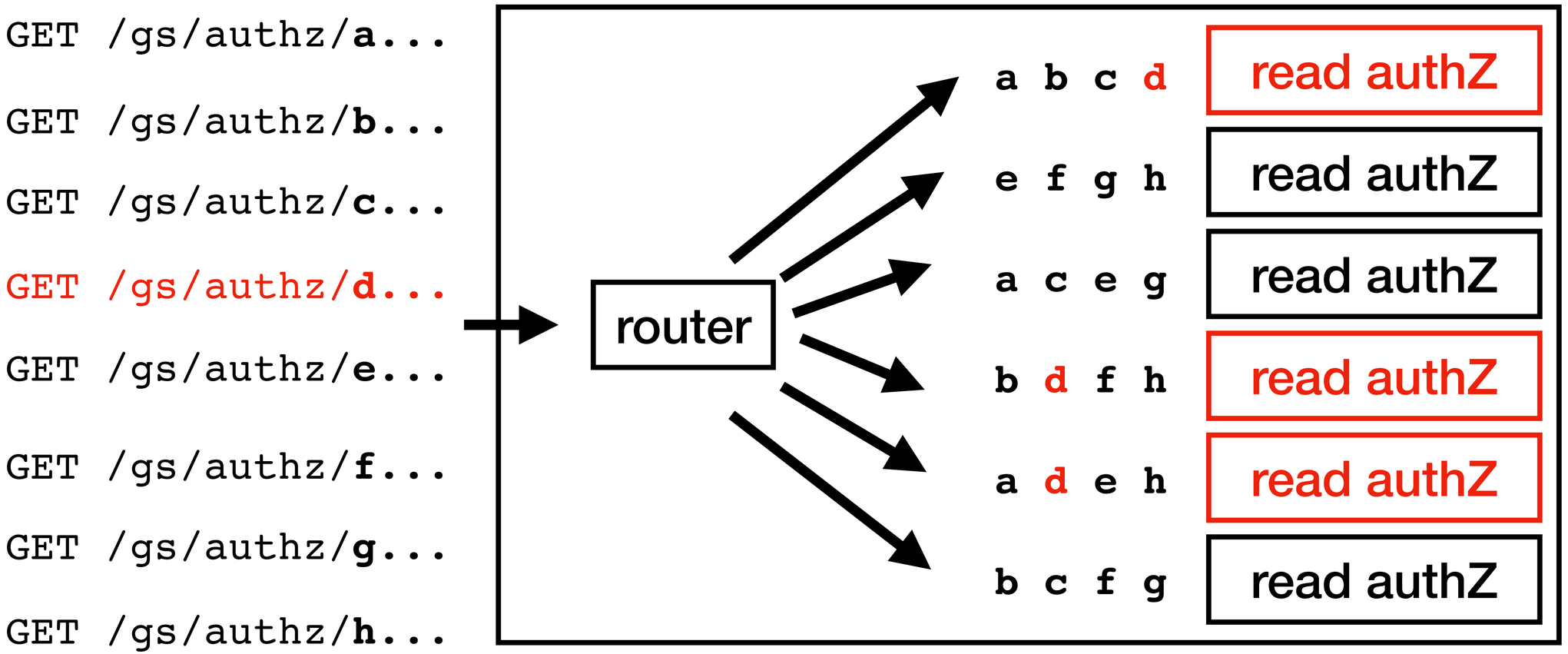
using URI rather than message inspection



sharding across clients: a, b, c, d, e, f, g, h

Shuffle Sharding

client d has error and takes down all its servers



client a, b, c, e, f, g, h still have a working server

XAuth Key Features

- RESTful API
- client.id and client.handle
- interaction modes
- claims from Grant Server
- JOSE client AuthN

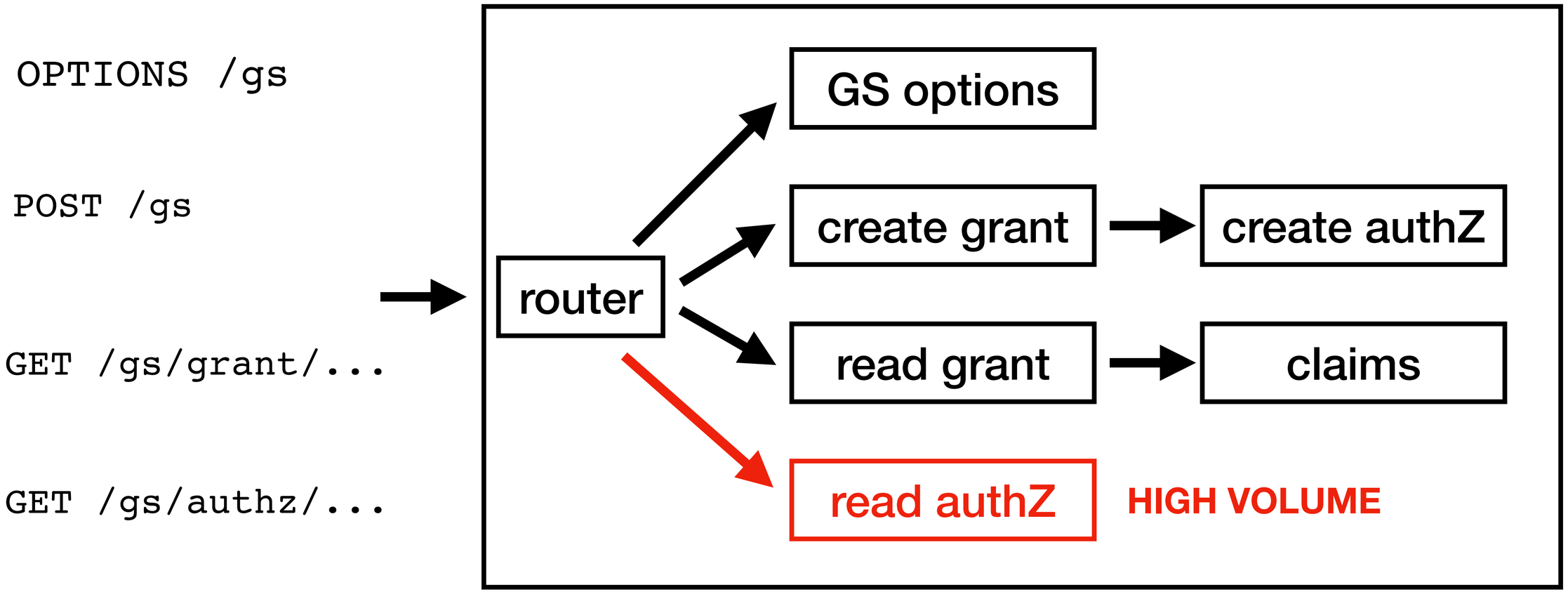
RESTful API

request	http verb	URI	response
Create Grant	POST	GS URI	interaction, wait, or grant
Verify Grant	PATCH	Grant URI	grant
Read Grant	GET	Grant URI	wait or grant
Read Authorization	GET	AZ URI	authorization
GS Options	OPTIONS	GS URI	metadata

Advanced APIs

request	http verb	URI	response
Create Grant	POST	GS URI	interaction, wait, or grant
Verify Grant	PATCH	Grant URI	grant
Read Grant	GET	Grant URI	wait or grant
Update Grant	**PUT**	**Grant URI**	**interaction, wait, or grant**
Delete Grant	**DELETE**	**Grant URI**	**success**
Read Authorization	GET	AZ URI	authorization
Update Authorization	**PUT**	**AZ URI**	**authorization**
Delete Authorization	**DELETE**	**AZ URI**	**success**
GS Options	OPTIONS	GS URI	metadata
Grant Options	**OPTIONS**	**Grant URI**	**metadata**
Authorization Options	**OPTIONS**	**AZ URI**	**metadata**

Decomposed Grant Server



Shuffle Sharding

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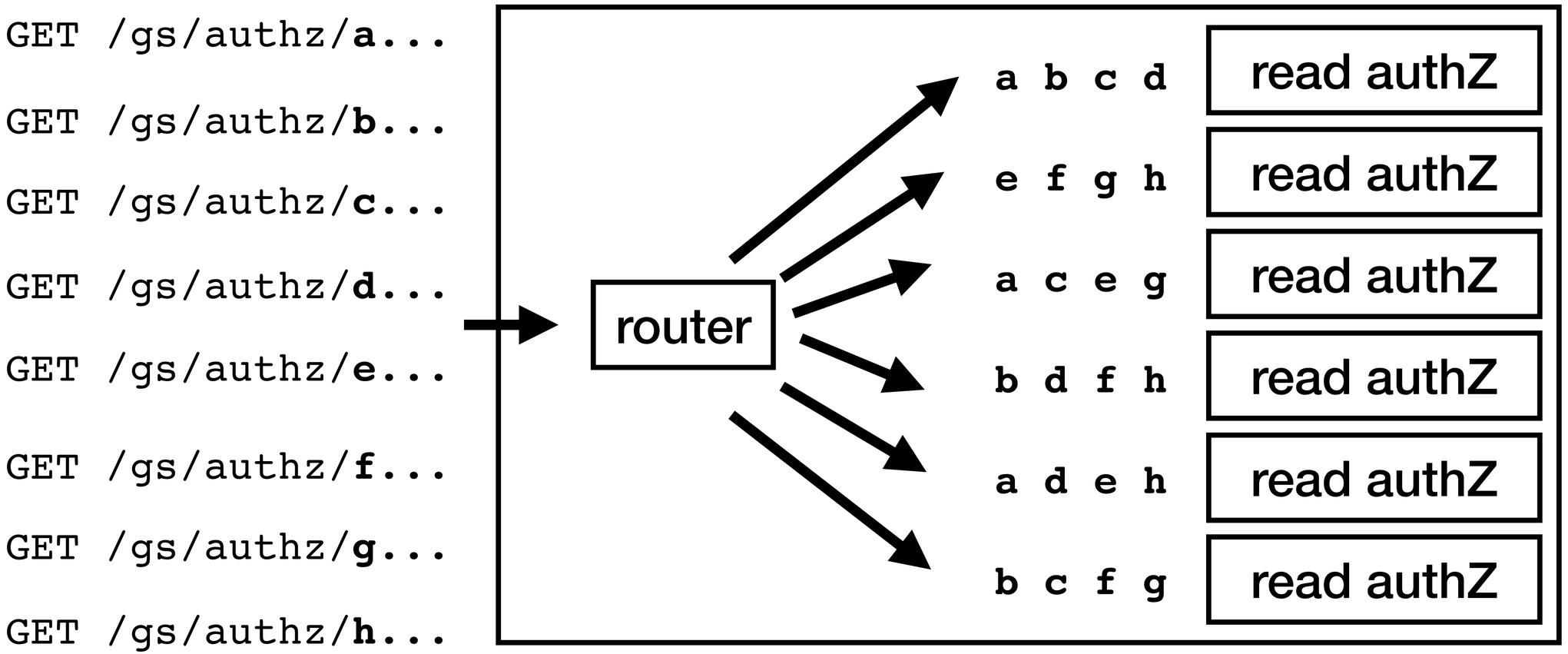
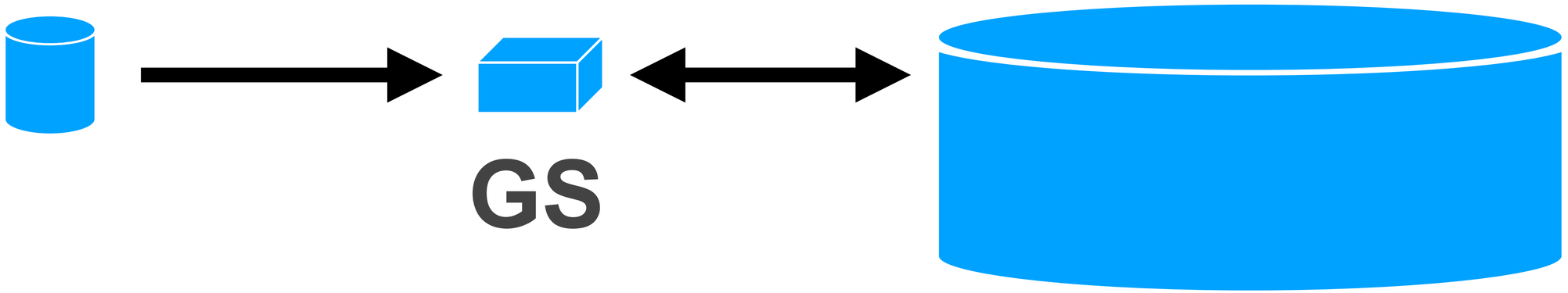


sharding across clients: a, b, c, d, e, f, g, h

Both client.id and client.handle

- client.id
- **registered** client
- identifier for **any** instance
- GS has **read-only** access
- **thousands** of ids

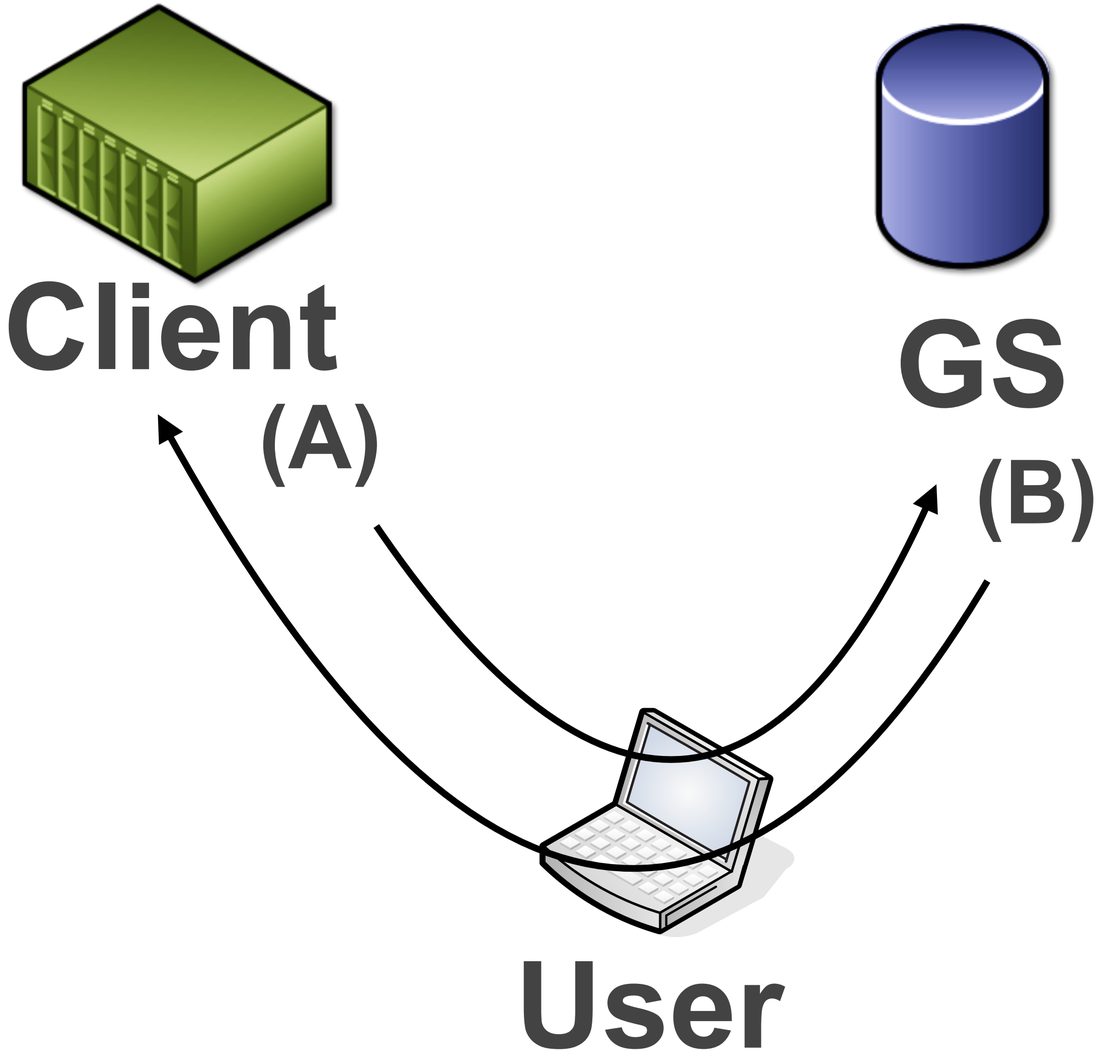
- client.handle
- **dynamic** client
- identifier for a **single** instance
- GS has **read/write** access
- **billions** of handles



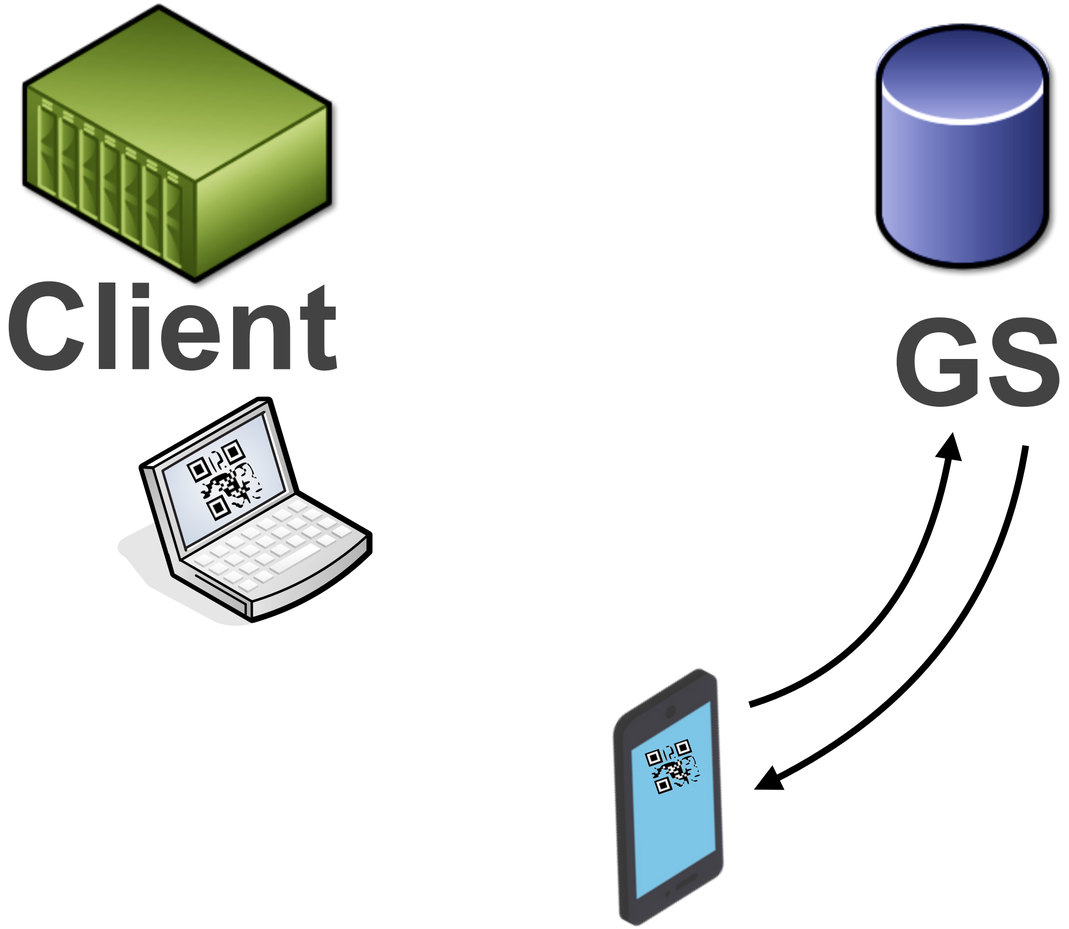
Interaction Modes

- **redirect** mode
  - user redirected to GS and back to Client
  - browser or mobile app2app
- decoupled modes
  - **user_code** - enter code on separate device
  - **indirect** - scan QR Code with phone
    susceptible to session fixation attacks

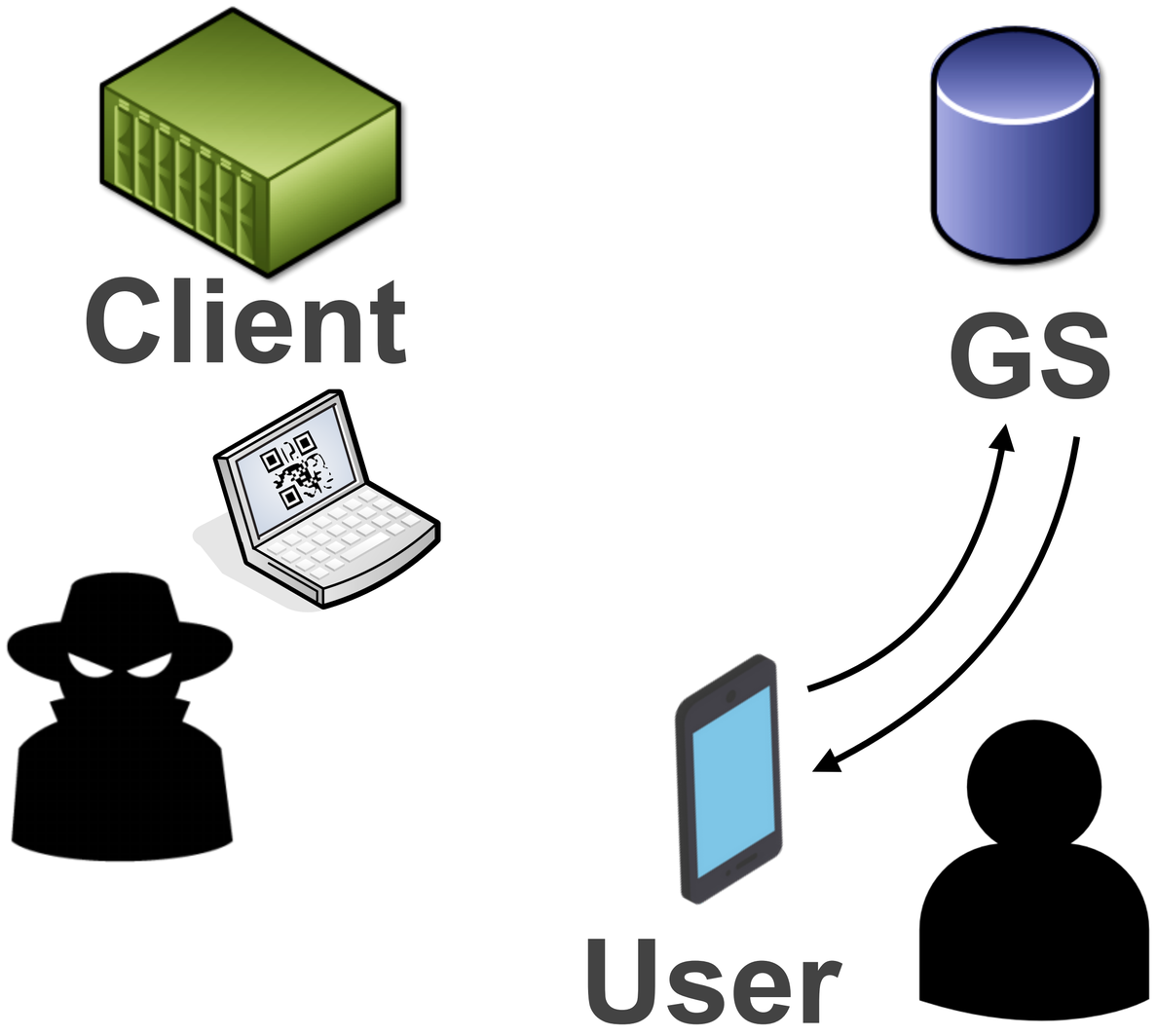
redirect mode



indirect mode



session fixation



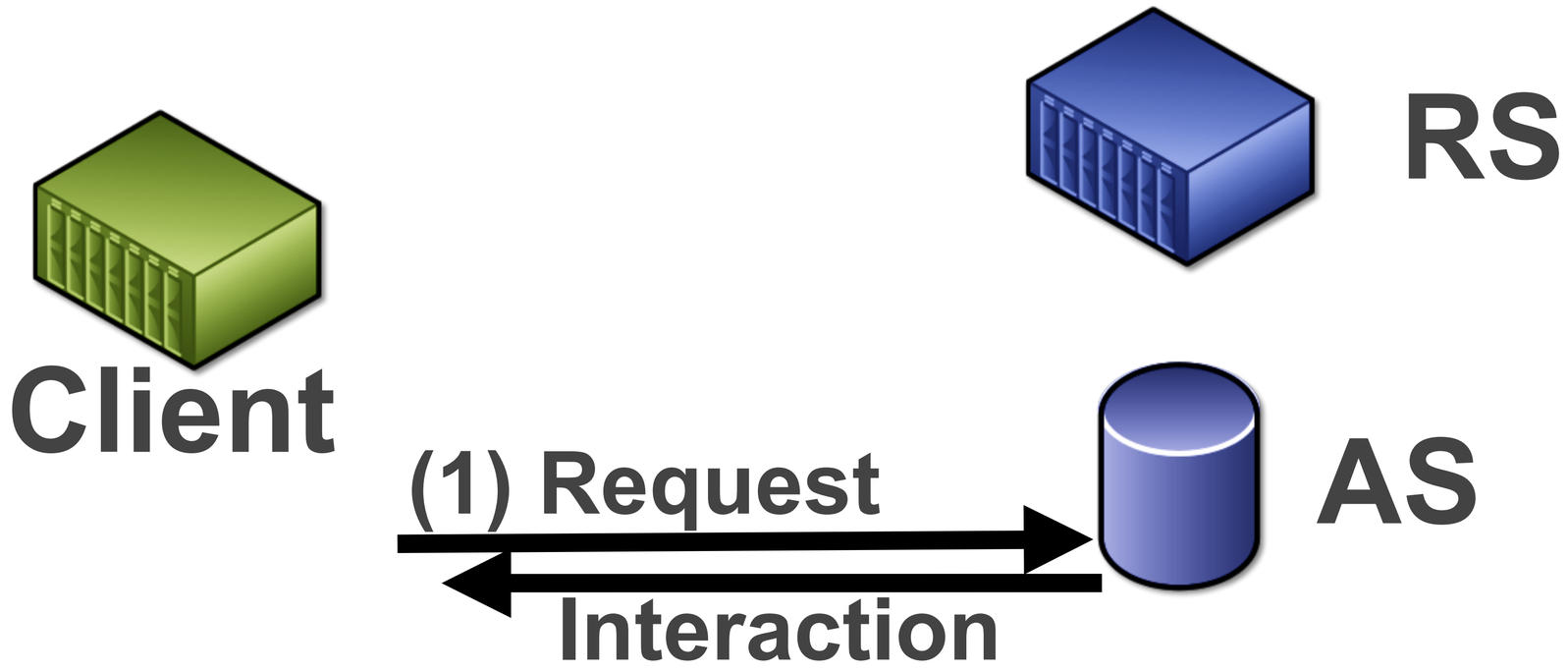
Interaction URI Examples

- **redirect** mode
  - -> completion_uri `https://client.example/complete/3902f52...`
  - <- redirect_uri `https://gs.example/redirect/f52d256a...`
- decoupled modes
  - -> information_uri `https://client.example/info`
  - <- **indirect** - indirect_uri `https://gs.example/indirect/5d2f63...`
  - <- **user_code** - display_uri `https://gs.example/code`

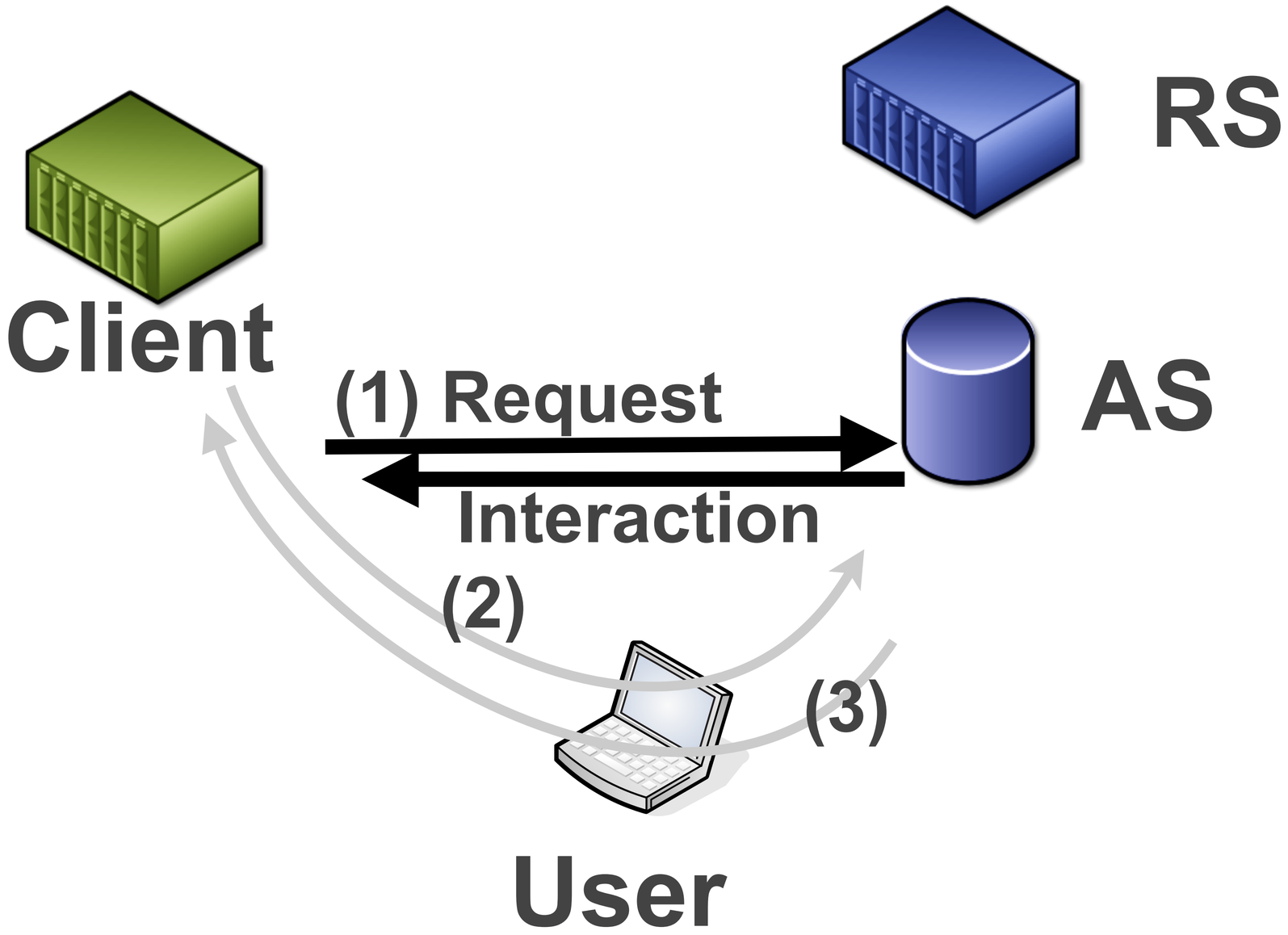
Claims from Grant Server

- Reuse OpenID Connect Claims
- Reuse OpenID Connect ID Tokens
- Reuse W3C Verified Credentials
- Extend with other claim schemas
- No access token required

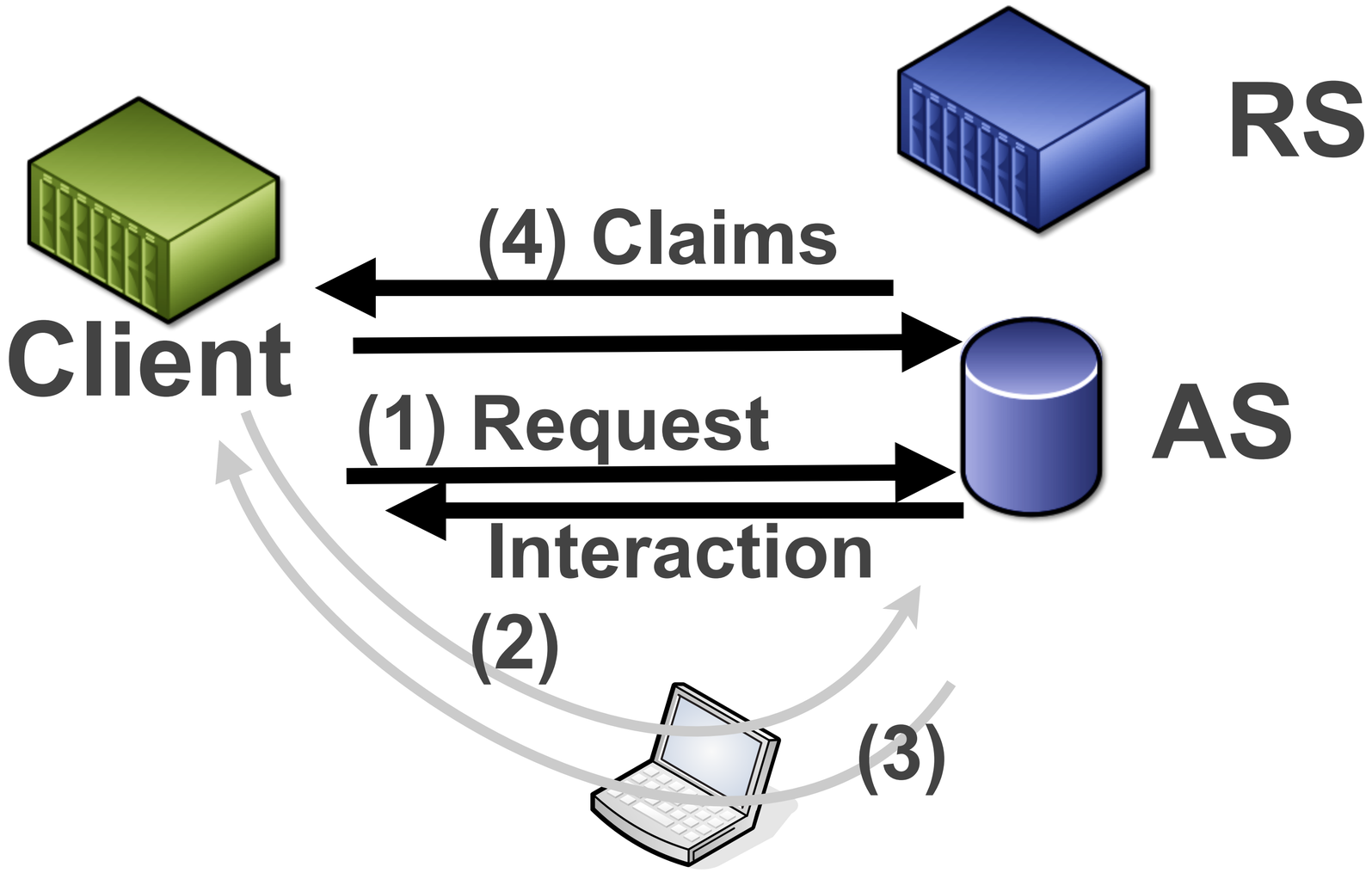
Claims Request



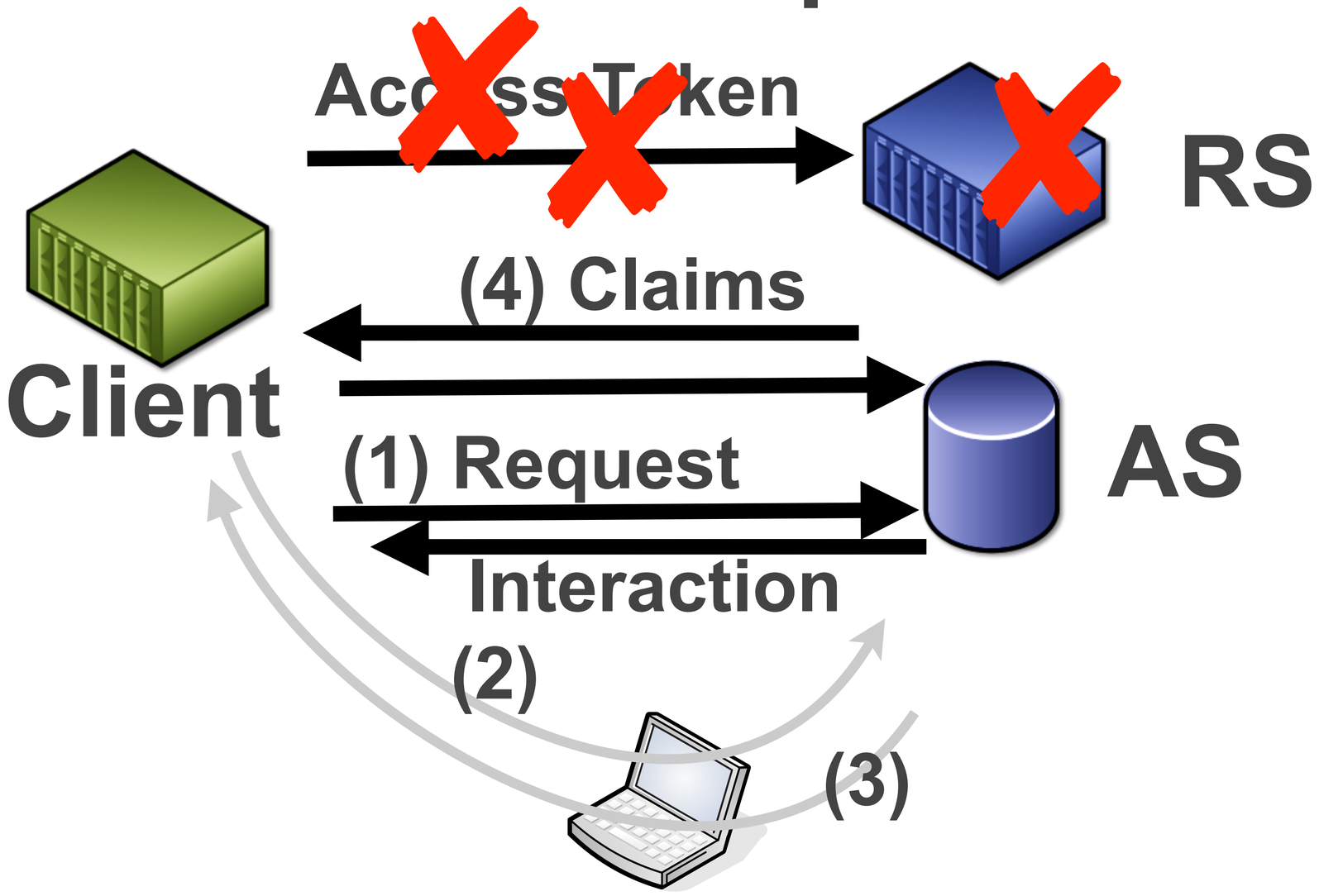
Claims Request



Claims Request



Claims Request



JOSE Client AuthN

- HTTP header (GET, OPTIONS, DELETE)
- HTTP body (POST, PUT, PATCH)
- include URI and HTTP method in payload

- non-repudiation of Client request
- use existing crypto libraries
- Grant Server components can verify Client independently

Implementation Confirmations

- claims.[schema] works well to determine if claims schema is supported
- authorization.type worked well to detect the authorization schema
- separate identifiers for dynamic and registered clients made client type policies easy
- interaction modes made enforcing interaction policies on request (eg. write access required redirect mode)
- representing grants and authorizations as URIs and using methods for different APIs made routing easy
- top level objects made it easy to decompose request processing
- warnings about ignored properties looks useful, but coding it is brittle
- using embedded JWK for dynamic client was straightforward
- Grant and AZ ids in URI allowed processing before request validation
- Fairly easy to add JOSE client authentication to on top of core protocol

Implementation Learnings

- space separated scopes from OAuth 2.x is a coding thunk
- OIDC claims having a null value is a thunk. Had to use hasOwnProperty instead of just testing value
- claims.oidc.userinfo.mail is a long path to ask for a claim
- separate top level objects for authorization and authorizations is clumsy
- having a '-' in a property name is messy in JS
- must peak into JOSE object to find client info to authenticate Create Grant - had to rework design
- JSON validation is brittle. JSON Schema?
- My HTML skills suck
- My ES6 knowledge is lacking

CLI Dynamic Client Grant Request w/JOSE

```
var key = await jose.JWK.createKey('EC', 'P-256', { alg: 'ES256', use: 'sig'})
let joseBody = await jose.JWS.createSign(
                                {   format: 'compact',
                                    fields: {jwk: key.toJSON() } },
                                 key)
                               .update(grantRequest,"utf8")
                               .final();
let opt = {
    method: 'POST',
    body: joseBody,
    headers: {  'Content-Type': 'application/jose',
                'Accept':'application/json'
             }
    }
let response = await fetch(config.gs.uri, opt);
```

Grant Server Routing Code

```
// GNAP APIs
router.options( '/', options.read);
if (config.gs?.auth?.required)
    router.use(auth.confirm);
router.post(    '/', grant.create);

router.get(     '/grant/:grant', grant.read);
router.put(     '/grant/:grant', grant.update);
router.patch(   '/grant/:grant', grant.verify);
router.delete(  '/grant/:grant', grant.delete);
router.options( '/grant/:grant', grant.options);

router.get(     '/az/:az', az.read);
router.put(     '/az/:az', az.update);
router.delete(  '/az/:az', az.delete);
router.options( '/az/:az', az.options);
```

Request Decomposition

```
    if (err = user.validate( grant )) return next(err);
    if (err = interaction.validate( grant )) return next(err);
    if (err = authorizations.validate( grant )) return next(err);
    if (err = claims.validate( grant )) return next(err);
```

Check Interaction Policy

```
    // indirect interaction not allowed if write scope requested
    if (checkScope( grant.context.authorizations, 'write')) {
        grant.verification = uuid();
        if (grant.context.interaction.indirect) {
            delete grant.context.interaction.indirect;
            if (0 == Object.keys(grant.context.interaction).length)
                return error.response( 403,
                    'write scope not available for indirect mode')
        }
    }
```

CLI Client QR Code

Scan and load the following QR Code:

CLI Client
Grant Read w/JOSE

```
let opt = {
        iat: utils.now(),
        nonce: uuid(),
        uri: json.uri,
        method: 'GET'
        };
let joseHeader = await jose.JWS.createSign( {format:'compact'}, key)
        .update(JSON.stringify(opt),"utf8")
        .final();
opt.headers = {
        'Accept':'application/json',
        'Authorization:': 'jose '+ joseHeader
        };
let response = await fetch(json.uri, opts);
```

draft-hardt-xauth-protocol
-06 vs -13

- split draft into 3 documents: core, advanced, JOSE
- authorization & authorizations => authorizations
- interaction mode negotiation
- authorizations are only RAR objects ("type" being AS defined)
- client handle for dynamic clients
- editorial

Advanced Features

- Wait Response
- Update, Delete, Options Grant
- Update, Delete, Options Authorization
- GS initiated Grant Creation
- Reciprocal Delegation
- user.exists - in Grant Request
- interaction.keep - multi-step interaction

Open Items

- SecEvent Subject Identifiers in user object?
- Add CIBA like interaction mode?
- array of RAR objects per authorization request?
- example OIDC userinfo RAR

```
"authorizations":{
    "type": "<name_space>/oidc_userinfo",
    "claims": { OIDC claims }
    }
```

- Simplify OIDC claims

```
"claims":{
  "oidc_userinfo" : { OIDC claims },
  "oidc_id_token" : { OIDC claims }
  }
```

Questions?