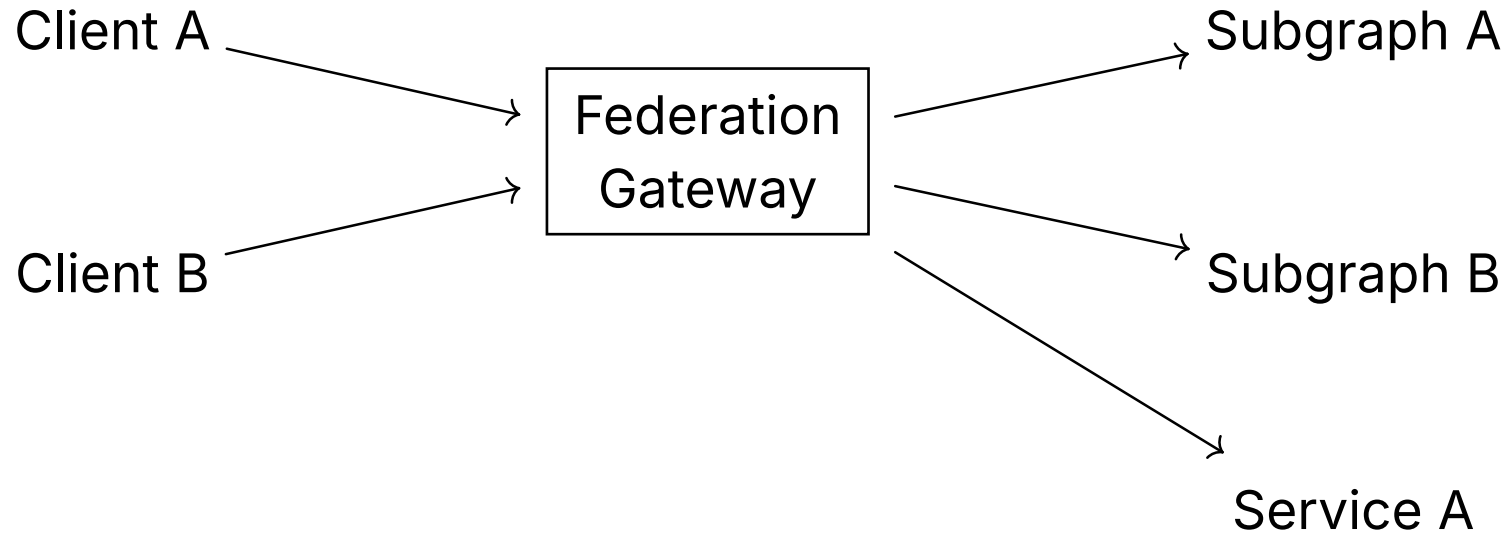




# Authorization in Federated GraphQL

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# Federated GraphQL



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- Single point of enforcement
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# Entity resolvers make subgraphs lose context

```
1 query {  
2   currentUser {  
3     friends {  
4       profilePictureUrl  
5       name  
6       photos {  
7         url  
8       }  
9     }  
10  }  
11 }
```

GraphQL

VS

```
1 query {  
2   _entities(representations: [  
3     { __typename: "User", id: "1" }  
4   ]) {  
5     ... on User {  
6       profilePictureUrl  
7       name  
8       photos {  
9         url  
10      }  
11    }  
12  }  
13 }
```

GraphQL



# Federation v2 Standard Directives

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- Based on *claims* aka *scopes*
- Claims are derived from:
  - JWT claims
  - Coprocessors

# Federation v2 Standard Directives


```
1 directive @authenticated on
2     FIELD_DEFINITION
3     | OBJECT
4     | INTERFACE
5     | SCALAR
6     | ENUM
```



Allows accessing the field or type when the request carries *any* verified JWT.

# Federation v2 Standard Directives

```
1 directive @requiresScopes(scopes: [[federation__Scope!]!]) on
2     FIELD_DEFINITION
3     | OBJECT
4     | INTERFACE
5     | SCALAR
6     | ENUM
```

 GraphQL

Allows accessing the field or type when the request has the required scopes/claims.

The outer list wrapper is interpreted as OR. The inner list wrapper is interpreted as AND.

# Federation v2 Standard Directives

```
1 directive @policy(policies: [[federation__Policy!]!]) on
2     FIELD_DEFINITION
3     | OBJECT
4     | INTERFACE
5     | SCALAR
6     | ENUM
```



Calls coprocessors or scripts for the given policies. A policy is just a name. The coprocessor has access to claims and context like request headers.

# Federation v2 Standard Directives

```
1 type Query {  
2     adminDashboard: AdminDashboard  
3     @policy(policies: [  
4         ["ip_is_allowlisted"],  
5         ["is_support_agent", "in_business_hours"],  
6     ])  
7 }
```



# Limitations

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  - Inputs to the fields
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- But decisions cannot be tied to **data**
  - Inputs to the fields
  - Output data returned by the subgraphs
- → **Relationships** cannot be enforced
  - "Users can see the photos on the profile of their friends"
  - "I can see the balance on my own bank account"
  - "I can see the medical records of my own patients"
  - "My direct manager can approve my expense requests if they are < 5000€"

# Comprehensive authorization in the Gateway

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- We want to make authorization decisions based on:
  - Request data

```
1 query {  
2     user(id: "user_015f91b8-eb7a-418a-8193-f72ddea5760d") {  
3         socialSecurityNumber  
4     }  
5 }
```



# Comprehensive authorization in the Gateway

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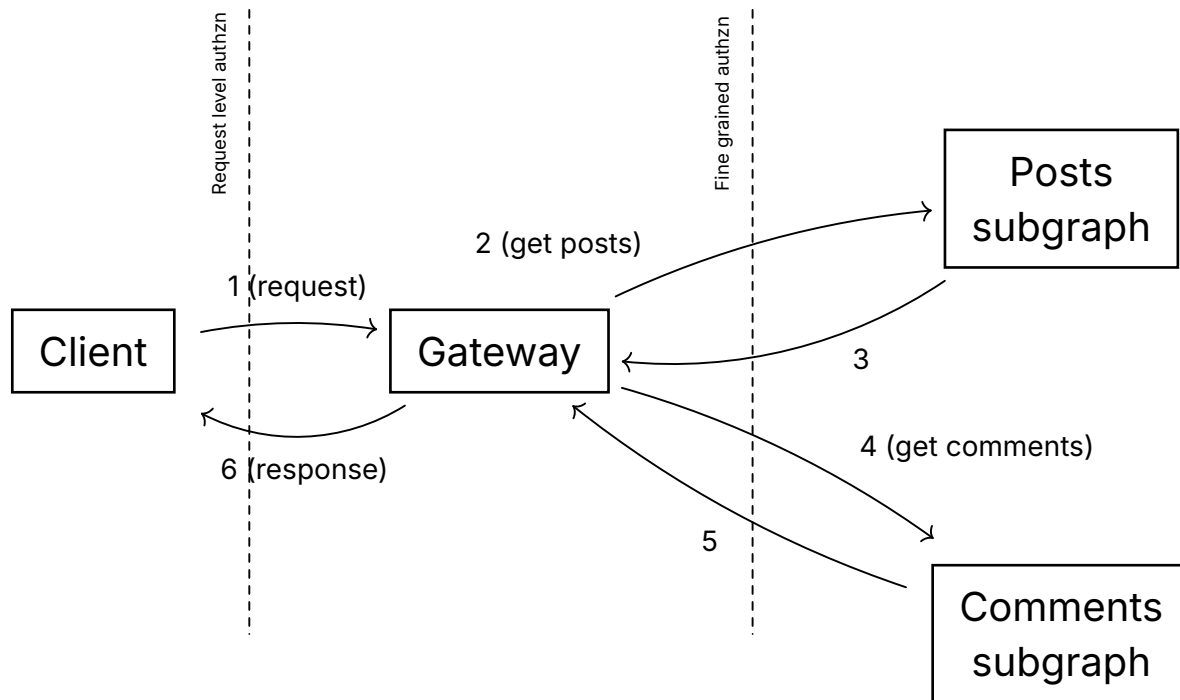


- And response data too
- → **Authorization must be taken into account by the query planner**

# Example

```
1 query PostsWithComments(  
2   $userID: ID!  
3 ) {  
4   posts(user: $userID) {  
5     title  
6     comments(includeHidden: true) {  
7       author { name }  
8       commentText  
9       createdAt  
10    }  
11  }  
12 }
```

GraphQL



# Our solution

- Achieved with **extensions**.
  - They can define their own directives that will be used by the Gateway for query planning.
  - Compiled to Wasm (WASI preview 2).
    - Near-native performance, in-process secure sandbox.
    - They can perform arbitrary IO (with configurable capabilities).

## Pre-subgraph request authorization: define a directive

```
1 extend schema
2   @link(
3     url: "https://specs.grafbase.com/grafbase",
4     import: ["InputFieldSet"])
5
6 directive @authorized(arguments: InputFieldSet = "**")
```





# Authorization on input data: apply the directive

```
1 extend schema
2   @link(
3     url: "https://extensions.grafbase.com/authorized/0.1.0",
4     import: ["@authorized"])
5
6 type Query {
7   bankAccountByEmail(email: String!): BankAccount @authorized
8 }
```



# Authorization on input data: implement authzn logic

```
1  #[derive(serde::Deserialize)]
2  struct Authorized<T> {
3      arguments: T,
4  }
5
6  #[derive(serde::Deserialize)]
7  struct BankAccountByUserEmailArguments {
8      email: String,
9  }
10
11 fn authorize_query(
12     &mut self,
13     headers: &mut SubgraphHeaders,
14     token: Token,
15     elements: QueryElements<'_>,
16 ) -> Result<impl IntoQueryAuthorization, ErrorResponse> {
17
```

 Rust

```

18     let mut builder = AuthorizationDecisions::deny_some_builder();
19     for element in elements {
20         let DirectiveSite::FieldDefinition(field) = element.directive_site() else {
21             unreachable!()
22         };
23         match (field.parent_type_name(), field.name()) {
24             ("Query", "bankAccountByEmail") => {
25                 let authorized: Authorized<BankAccountByEmailArguments> =
26                     element.directive_arguments()?;
27                 if authorized.arguments.email != "george@pizzahut.com" {
28                     builder.deny(element, "Access denied");
29                 }
30             }
31             _ => unreachable!(),
32         }
33     }
34     Ok(builder.build())
35 }

```

## Authorization on output data

- Takes place when a subgraph request is planned
- Will cause the field to become null, with your authorization error in errors
- The field and its subfields will not even be requested from the subgraph

# Response authorization

```
1 type User @key(fields: "id") {  
2   id: ID!  
3   email: String!  
4   userType: UserType  
5   socialSecurityNumber: String @policy(  
6     policies: ["check_access_to_user_ssn"]  
7   )  
8 }
```



Assume we need the `id` and `userType` of the user in addition to the current request context to control access to the social security number.

# Response authorization: Problem

Looks good, but...

```
1 query {  
2   userByEmail(email: "george@pizzahut.com") {  
3     socialSecurityNumber  
4   }  
5 }
```



The `id` and `userType` fields are not going to be available, so our plugin / coprocessor does not have the data it needs to make authorization decisions.

# Response authorization: Solution

We define a directive that declaratively pulls in the fields we need in order to make a decision:

```
1 extend schema
2   @link(
3     url: "https://specs.grafbase.com/grafbase",
4     import: ["FieldSet"])
5
6 directive @guard(requires: FieldSet!)
```



# Response authorization: Solution

Then we apply it:

```
1  extend schema
2    @link(
3      url: "https://extensions.grafbase.com/authorized/0.1.0",
4      import: ["@guard"])
5
6  type User @key(fields: "id") {
7    id: ID!
8    email: String!
9    userType: UserType
10   socialSecurityNumber: String @guard(
11     requires: "id userType { canReadSensitiveInfo }"
12   )
13 }
```





# Takeaways

- Authorization decision for each annotated field or type can depend on **inputs (arguments)** or **arbitrary associated data**.

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- Integrated in the **query planner**
  - It's a requirement
  - Avoids requesting what the current client request is not authorized to see
  - Potentially requests extra fields that are not needed to resolve the GraphQL query, but are required to make authorization decisions.

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- Authorization decision for each annotated field or type can depend on **inputs (arguments)** or **arbitrary associated data**.
- Integrated in the **query planner**
  - It's a requirement
  - Avoids requesting what the current client request is not authorized to see
  - Potentially requests extra fields that are not needed to resolve the GraphQL query, but are required to make authorization decisions.
- All these decisions **batched** by the query planner.
- Enables **fine grained Attribute-based Access Control (ABAC)** and **Relation-based Access Control (ReBAC)**.

**Also**

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Workshop!

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Workshop! Tomorrow!

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Grote Zaal - 2nd Floor.



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Grote Zaal - 2nd Floor. 10:45am.

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Thank you!



# Links

- [Blog post on fine-grained authorization by Permit.io](#)
- [Docs on Apollo Federation v2 built-in authorization directives](#)
- Grafbase Authorization extensions:
  - [Grafbase blog post: Custom Authentication and Authorization in GraphQL Federation](#)
  - [Example project for authorization extensions](#)