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JAX-RS Security

CREATE
THE
FUTURE

Michal Gajdos
michal.gajdos@oracle.com

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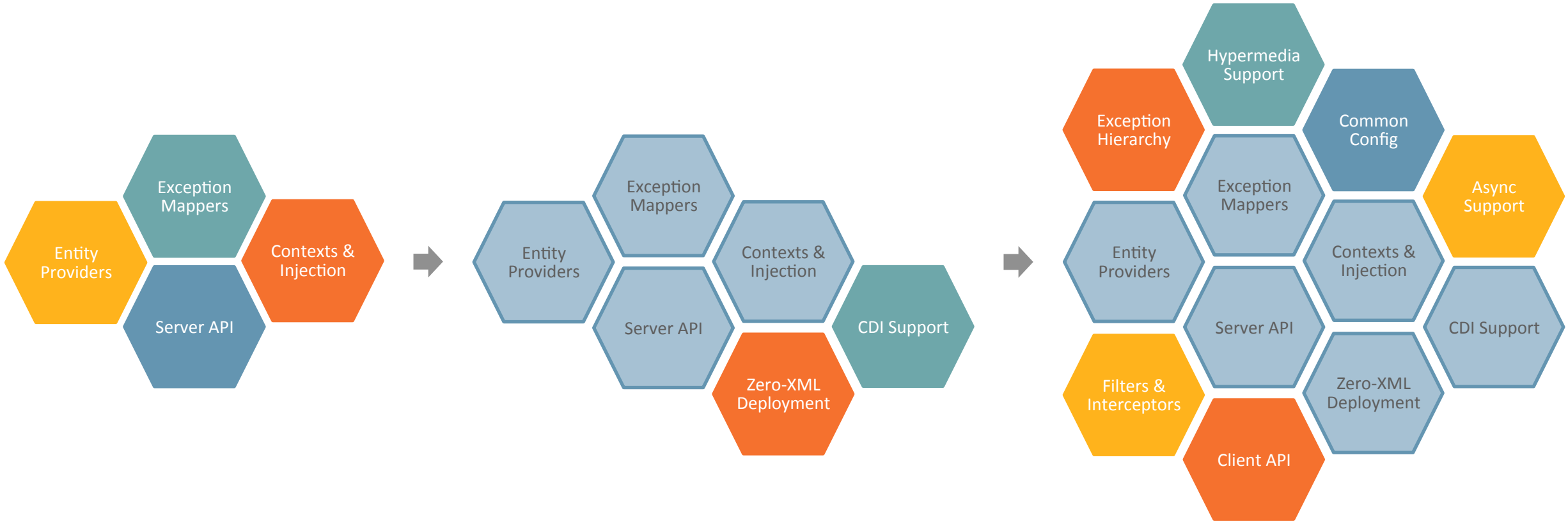
Program Agenda

1. Introduction to JAX-RS and Security
2. Declarative Security and Entity Filtering
3. Client Security
4. OAuth

Evolution of JAX-RS API



JAX-RS 1.0 **JAX-RS 1.1** **JAX-RS 2.0**

Introduction to JAX-RS

`http://example-university.com`

`/api/students`

… ***POST*** *(create) new student*

`/api/students/{id}`

… ***GET*** *existing student with given* ***id***

Introduction to JAX-RS

`http://example-university.com`

`/api/students`

*… **POST** new student*

`http://example-university.com/api/students/{id}`

*… **GET** existing student with given **id***

Introduction to JAX-RS

http://example-university.com/api/students

```
POST /api/students HTTP/1.1
Host: example-university.com
Content-Type: application/json
...

{
    "name": "Michal Gajdos"
    "phone": …
    …
}
```

Introduction to JAX-RS

```
http://example-university.com/api/students/mgajdos
```

```
GET /api/students/mgajdos HTTP/1.1
User-Agent: curl/7.30.0
Host: example-university.com
Accept: application/json
```

Introduction to JAX-RS – Resource

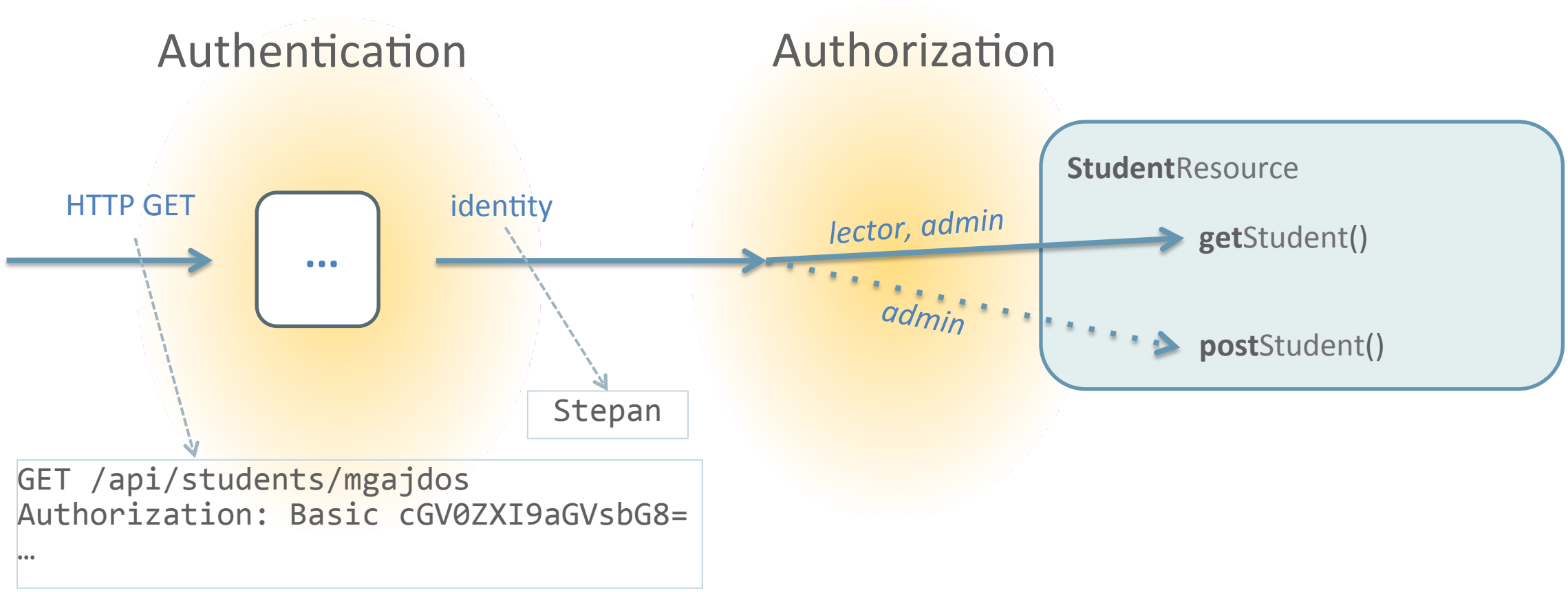
```
@Path("students")
public class StudentResource {
    @GET
    @Path("{id}")
    @Produces("application/json")
    public Student getStudent(@PathParam("id") String id) {
        return StudentService.getStudentById(id);
    }


    @POST
    @Consumes("application/json")
    public Student postStudent(Student student) {
        return StudentService.addStudent(student);
    }
}
```

http://example-university.com/api/**students/{id}**

JAX-RS Security

JAX-RS and Security



JAX-RS and Security

Authentication

- No support in JAX-RS
- Authenticate the REST API caller
- JAX-RS processing is based on Servlet container
  - **Servlet security mechanisms**
- Internal JAX-RS security
  - Based on JAX-RS container request filter (ContainerRequestFilter)
- Result of authentication: JAX-RS **SecurityContext**
- Authentication mechanisms
  - Basic, Digest, OAuth Access Token, JWT (JSON Web Token)

JAX-RS and Security

Authorization

- No support in JAX-RS
- Could use the authorization support based on Servlets
  - web.xml security definition (or @ServletSecurity, @HttpConstraint)
- **Servlet security is “weak” for grain-defined authorization in JAX-RS**
- Implementation specific solutions
  - Based on SecurityContext
  - ContainerRequestFilters
  - @RolesAllowed

JAX-RS and Security – Using web.xml

```
<security-constraint>
    <web-resource-collection>
        <url-pattern>/*</url-pattern>
    </web-resource-collection>
    <auth-constraint>
        <role-name>admin</role-name>
    </auth-constraint>
</security-constraint>

<login-config>
    <auth-method>BASIC</auth-method>
    <realm-name>my-realm</realm-name>
</login-config>
```

JAX-RS and Security – Using web.xml

```
<security-constraint>
    <web-resource-collection>
        <url-pattern>
            /students/*
        </url-pattern>
        <http-method>POST</http-method>
    </web-resource-collection>

    <auth-constraint>
        <role-name>admin</role-name>
    </auth-constraint>

</security-constraint>
```

```
<security-constraint>
    <web-resource-collection>
        <url-pattern>
            /students/*
        </url-pattern>
        <http-method>GET</http-method>
    </web-resource-collection>

    <auth-constraint>
        <role-name>admin</role-name>
        <role-name>lector</role-name>
    </auth-constraint>
</security-constraint>
```

JAX-RS and Security – SecurityContext extension point

```
public interface SecurityContext {

    public Principal getUserPrincipal();

    public boolean isUserInRole(String role);

    public boolean isSecure();

    public String getAuthenticationScheme();

}
```

Introduction to JAX-RS – Resource

```
@Path("students")
public class StudentResource {

    @Context
    private SecurityContext securityContext;

    @POST
    @Consumes("application/json")
    public Student postStudent(Student student) {
        if (!securityContext.isUserInRole("admin")) {
            throw new WebApplicationException(403); // 403 = Forbidden
        }
        return StudentService.addStudent(student);
    }
}
```

Securing Resources in JAX-RS

- New Security JSR planned for Java EE 8
  - Focused on unification, ease of use and portability improvements
  - JAX-RS EG will monitor progress of this JSR
- OAuth 2.0 gaining a lot of adoption from many big players
  - Google, Facebook, Twitter, …
- Vision for REST Services Security Model in Java EE
  - Easy and Straightforward
  - Declarative whenever possible
    - Java EE Security Annotations fit JAX-RS very well
    - Jersey already provides annotation-based authorization

JAX-RS Security – Existing Extension Points

- Server-side
  - `SecurityContext`
    - Get security-related information
  - `ContainerRequestFilter`, `ContainerResponseFilter`
    - Perform security-related tasks at request level
  - `DynamicFeature`
    - Attach security enforcement facilities selectively

- Client-side
  - `ClientRequestFilter`, `ClientResponseFilter`
    - Perform security-related tasks at request level

Existing Jersey Security Features

- Leveraging standard JAX-RS extension points
- Off-the-shelf modules & components ready to use

- Client-side
  - HTTP Basic & Digest Authentication Support
- Server-side
  - Declarative Role-base Authorization (`javax.annotation.security`)
    - `@RolesAllowed`, `@PermitAll`, `@DenyAll`

- OAuth 1.0, 2.0 Support
  - Client and Server Side

Security Annotations

- Define the access to resources based on the user groups
- Security annotations from `javax.annotation.security` package
  - `@PermitAll`, `@DenyAll`, `@RolesAllowed`
  - `SecurityContext`
- `RolesAllowedDynamicFeature`

Registering RolesAllowedDynamicFeature

```
@ApplicationPath("api")
public class MyApplication extends ResourceConfig {

    public MyApplication() {
        packages("com.example.university");

        register(RolesAllowedDynamicFeature.class);
    }
}
```

Security Annotations – Restrictions

```
@Path("students")
@DenyAll
public class StudentResource {
    @GET
    @Path("{id}")
    @Produces("application/json")
    @PermitAll
    public Student getStudent(@PathParam("id") String id) {
        return StudentService.getStudentById(id);
    }

    @POST
    @Consumes("application/json")
    @RolesAllowed("admin")
    public Student postStudent(Student student) {
        return StudentService.addStudent(student);
    }
}
```

No access by default

Public access

Only “admin” role

Entity Filtering

Entity Filtering

Idea and Motivation

- Exposing only part of domain model for input/output
- Reduce the amount of data exchanged over the wire
- Define own filtering rules based on current context
  - Resource method
- Assign security access rules to properties
- Faster prototyping and development
  - One model and one place for defining the rules

Entity Filtering

Jersey 2.3+ / MOXy JSON, Jackson 2.x

- `@EntityFiltering` meta-annotation
  - Create filtering annotations to define context
  - Create filtering annotations with custom meaning to define context
- Security annotations from `javax.annotation.security` package
  - `@PermitAll`, `@DenyAll`, `@RolesAllowed`
  - `SecurityContext`
  - `SecurityEntityFilteringFeature`

Entity Filtering – Model

```
public class Student {

    private String name;
    private String login;
    private String password;

    private DormAddress dormAddress;

    // ...

    // getters and setters
}
```

```
public class DormAddress {

    private String street;
    private String city;

    private String room;

    // ...

    // getters and setters
}
```

Entity Filtering – Annotated Model

```
public class Student {

    public String getName();

    @PermitAll
    public String getLogin();

    @DenyAll
    public String getPassword();

    @RolesAllowed({"lector", "admin"})
    public DormAddress getDormAddress();

    // ...
}
```

```
public class DormAddress {

    public String getStreet();
    public String getCity();

    @RolesAllowed("admin")
    public String getRoom();

    // ...
}
```

Entity Filtering – Un-Restricted Resource

```
@Path("students")
public class StudentResource {
    @GET
    @Path("{id}")
    @Produces("application/json")
    public Student getStudent(@PathParam("id") String id) {
        return StudentService.getStudentById(id);
    }
}
```

```
Student:
    {"name":"Michal Gajdos","login":"gajdm3am"}
Lector:
    {"name":"Michal Gajdos","login":"gajdm3am",
     "dormAddress":{"city":"Praha", "street":"Patkova 3"}}
Admin:
    {"name":"Michal Gajdos","login":"gajdm3am",
     "dormAddress":{"city":"Praha", "street":"Patkova 3","room":"1412"}}
```

Entity Filtering – Restricted Resource

```
@Path("students")
@DenyAll
public class StudentResource {
    @GET
    @Path("{id}")
    @Produces("application/json")
    @PermitAll
    public Student getStudent(@PathParam("id") String id) {
        return StudentService.getStudentById(id);
    }

    @POST
    @Consumes("application/json")
    @RolesAllowed("admin")
    public Student postStudent(Student student) {
        return StudentService.addStudent(student);
    }
}
```

Client Security

JAX-RS 2.0 – Client APIs

```
Client client = ClientBuilder.newClient();

WebTarget universityApi = client.target("http://example-university.com/api");

WebTarget students = universityApi.path("students")
                                  .register(JacksonFeature.class);

WebTarget student = students.path("{id}");

Student mgajdos = student.resolveTemplate("id", "mgajdos")
                         .request("application/json")
                         .get(Student.class);
```

JAX-RS 2.0 – SSLContext and SslConfigurator

```
SslConfigurator sslConfig = SslConfigurator.newInstance()
                .trustStoreFile("./truststore_client")
                .trustStorePassword("pwds65df4")
                .keyStoreFile("./keystore_client")
                .keyPassword("sf564fsds");

Student mgajdos = ClientBuilder.newBuilder()
                    .sslContext(sslConfig.createSSLContext())
                    .register(JacksonFeature.class)
                    .build()
                    .target("https://example-university.com/api/students/mgajdos")
                    .request("application/json”)
                    .get(Student.class);
```

Jersey Client Authentication Filters

- Jersey specific filters
  - ClientRequestFilter and ClientResponseFilter
- HttpAuthenticationFeature
  - HTTP Basic Authentication
  - HTTP Digest Authentication
- OAuth1 and OAuth2
  - OAuth1ClientSupport
  - OAuth2ClientSupport

Jersey Client Authentication Filters

```
HttpAuthenticationFeature basic = HttpAuthenticationFeature
                                    .basic("mgajdos", "secret123")
                                    .nonPreemptive()
                                    .build();

HttpAuthenticationFeature digest = HttpAuthenticationFeature
                                    .digest("mgajdos", "secret123").build();

HttpAuthenticationFeature universal = HttpAuthenticationFeature
                                        .universal("mgajdos", "secret123").build();


WebTarget student = universityApi.path("students/{id}")
                                 .register(JacksonFeature.class)
                                 .register(universal);
```

OAuth

Introduction to OAuth

Resource owner

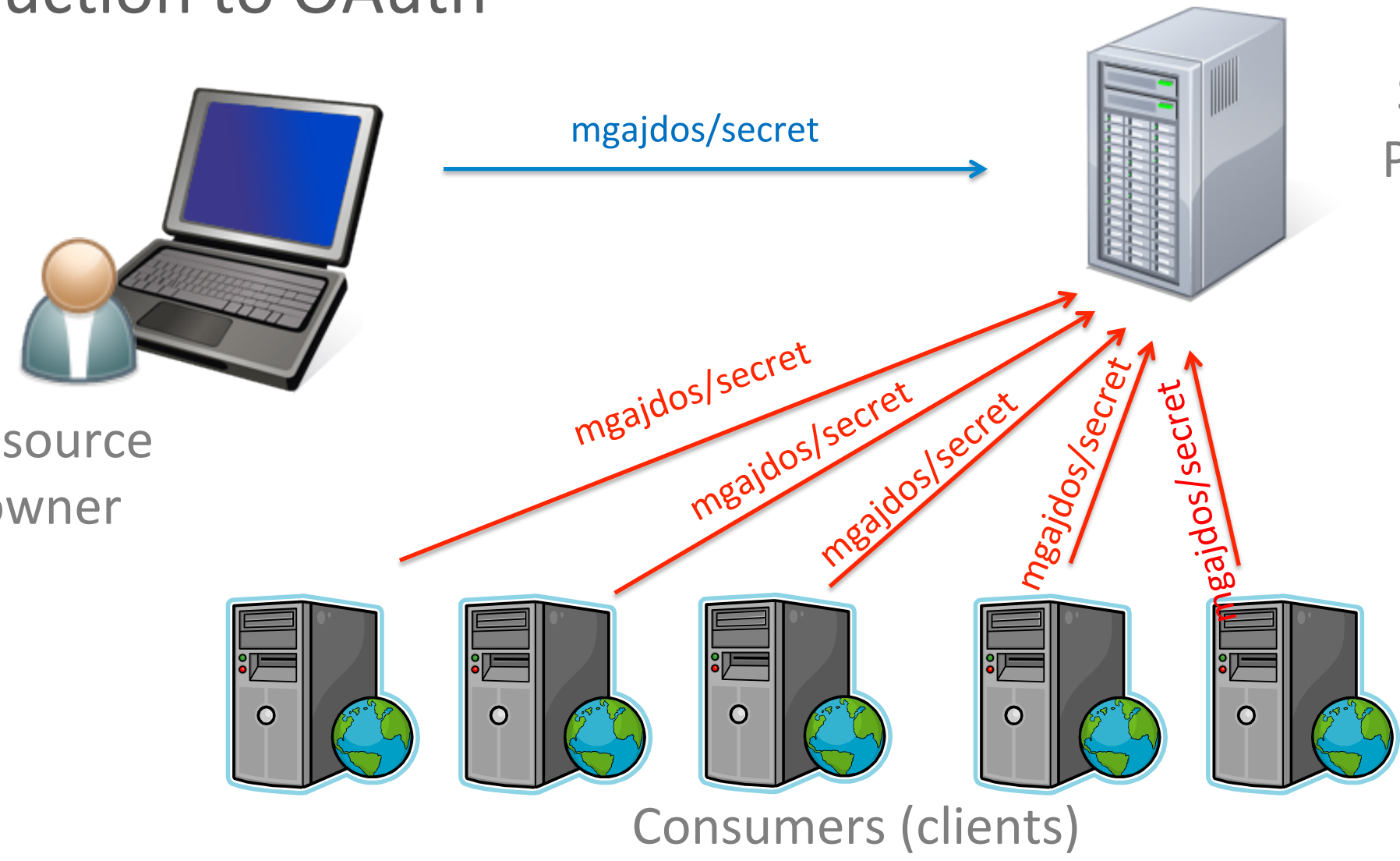
username/password

Service Provider

username/password?

Consumer (client)

Introduction to OAuth



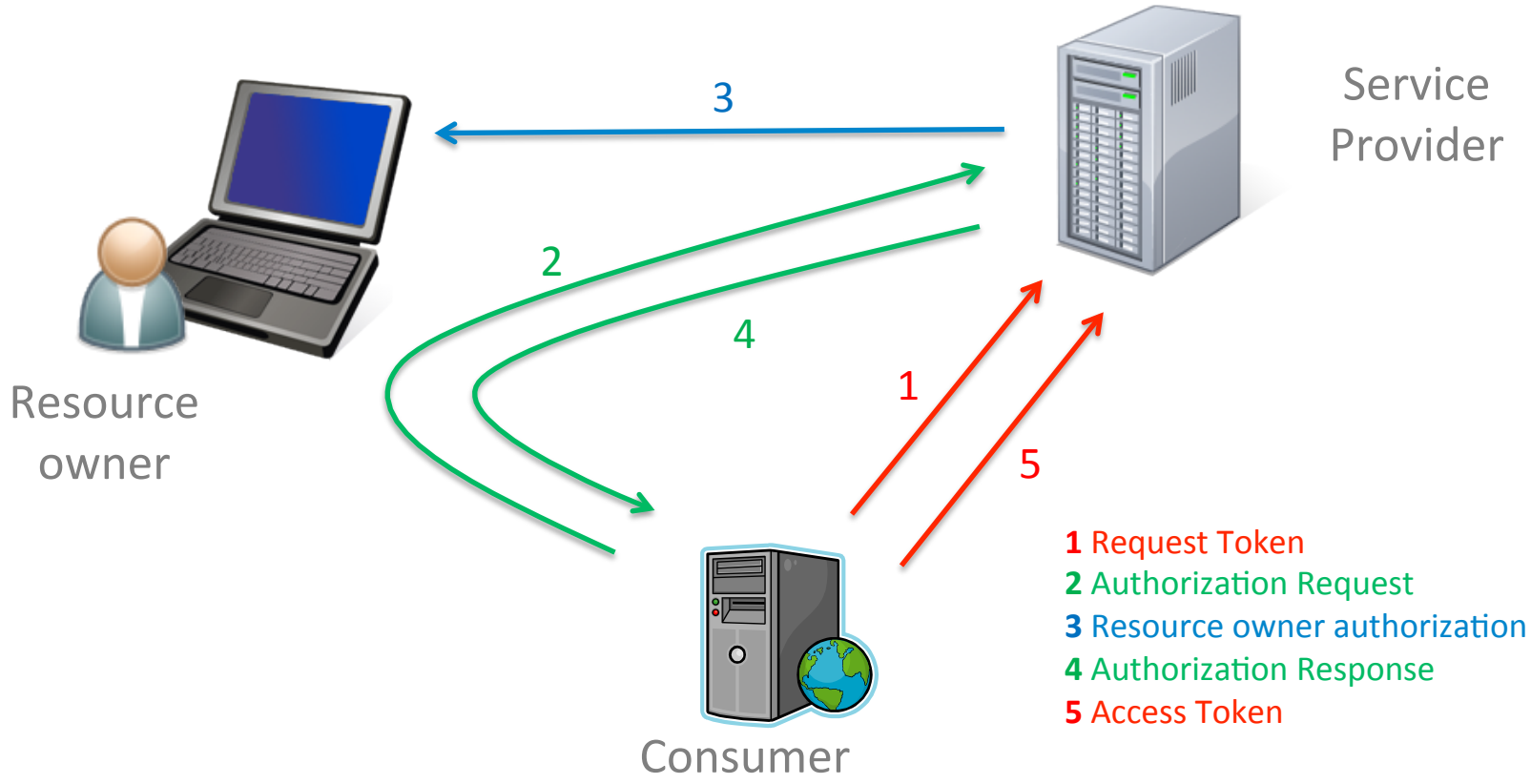
Introduction to OAuth

- Problems of giving consumers my password
  - Revoking access
  - Password change
  - Limit access (different authorization rules)
  - Trust
- Solution is OAuth
  - Access Token
    - Make authenticated requests using Access Token in HTTP header
  - Authorization Flow
    - Process of issuing new Access Token

OAuth1

- IETF OAuth 1.0 (RFC 5849)
  - Previous community version 1.0 and 1.0a
- Signatures added to requests (HMAC-SHA1, RSA-SHA1) based on secret keys
- Authorization process (flow)
  - Process of granting access to the consumer

OAuth1 – Obtaining Access Token



OAuth1

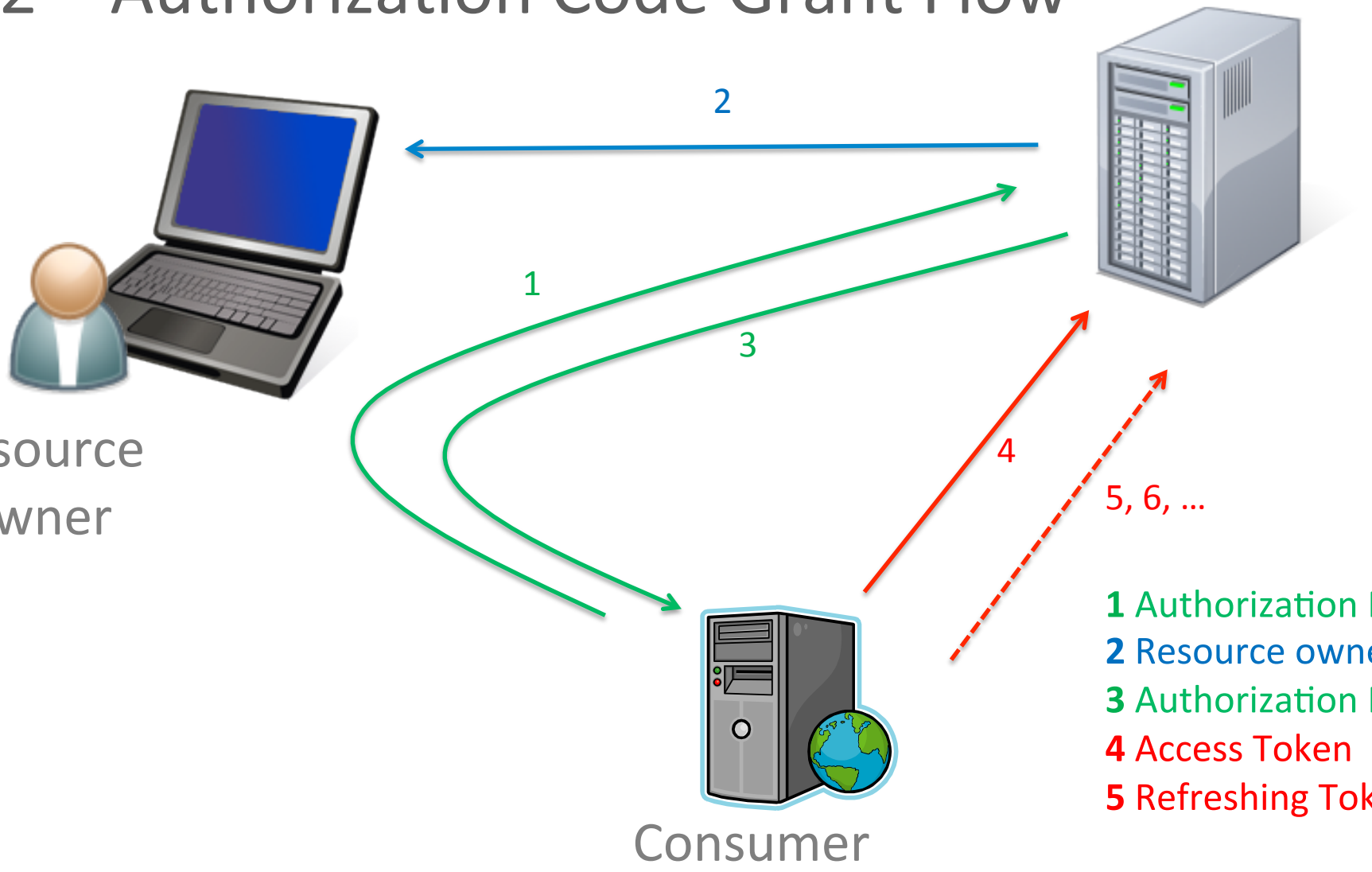
Summary

- Secure
  - Signatures
  - Secret keys (consumer secret, request and access token secret)
  - nonce, timestamp
- Complex for implementation

OAuth2

- OAuth 2.0 (IETF, RFC 6749), released in October 2012
- Not backward compatible, framework (not protocol)
- Does not require signatures (bearer token), SSL
- **Easier** to implement
- Authorization flows
  - Authorization Code Grant (refresh token)
  - Implicit Grant (e.g. Javascript client)
  - Resource Owner Password Credentials Grant (user name + password)
  - Client Credentials Grant (client app authentication)

OAuth2 – Authorization Code Grant Flow



OAuth2 – Authorization Code Grant Flow

Resource owner

Service Provider

Access Token

Consumer

```
GET /api/students/mgajdos HTTP/1.1
User-Agent: curl/7.30.0
Host: example-university.com
Accept: application/json
Authorization: bearer jkr3ljkh3jk
```

JAX-RS/Jersey and OAuth

JAX-RS Client and OAuth

- Non-JAX-RS solution
  - Service Providers (e.g. Google, Facebook) provide libraries in more programming languages to use their services
  - Other libraries
- JAX-RS Client acts as a Consumer/Client party in OAuth scenario
- Functionality
  - Perform Authorization Flow
  - Make authenticated requests (*ClientRequestFilter*s, *ClientResponseFilter*s)

JAX-RS Server and OAuth

- Non JAX-RS solutions based on servlet container
  - Authorization Flow: Servlets or Filters
  - Authenticated requests: JASPIC SAM module (Identity Propagation)
  - Specific solution of application servers (e.g., Weblogic)
- JAX-RS solution
  - Authorization Flow: *JAX-RS resources*
  - Authenticated requests: *ContainerRequestFilters*

Jersey and OAuth

- OAuth 1
  - Client
  - Server
- OAuth 2 (Authorization Code Grant Flow)
  - Client
  - *Server [in progress]*

DEMO

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Jersey/WebLogic Team is Hiring in Prague!

http://marek.potociar.net/2014/10/15/jersey-is-hiring-in-prague/

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