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Java EE 8

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Java Day Tokyo 2015
April 8, 2015

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Program Agenda

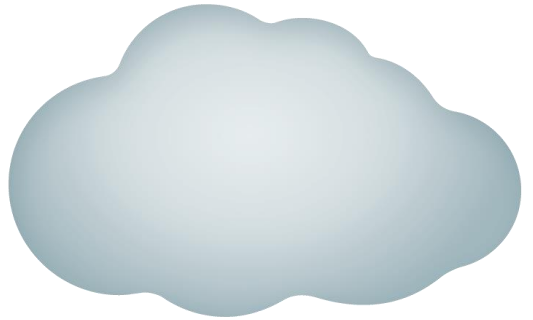
Overview of Java EE 8

1. How did we decide on content and goals of Java EE 8 ?
2. What are we planning?
3. How can you get involved?

Industry Trends We're Seeing

Cloud

HTTP/2



Mobile

User Experience

Reactive Programming

SECURITY

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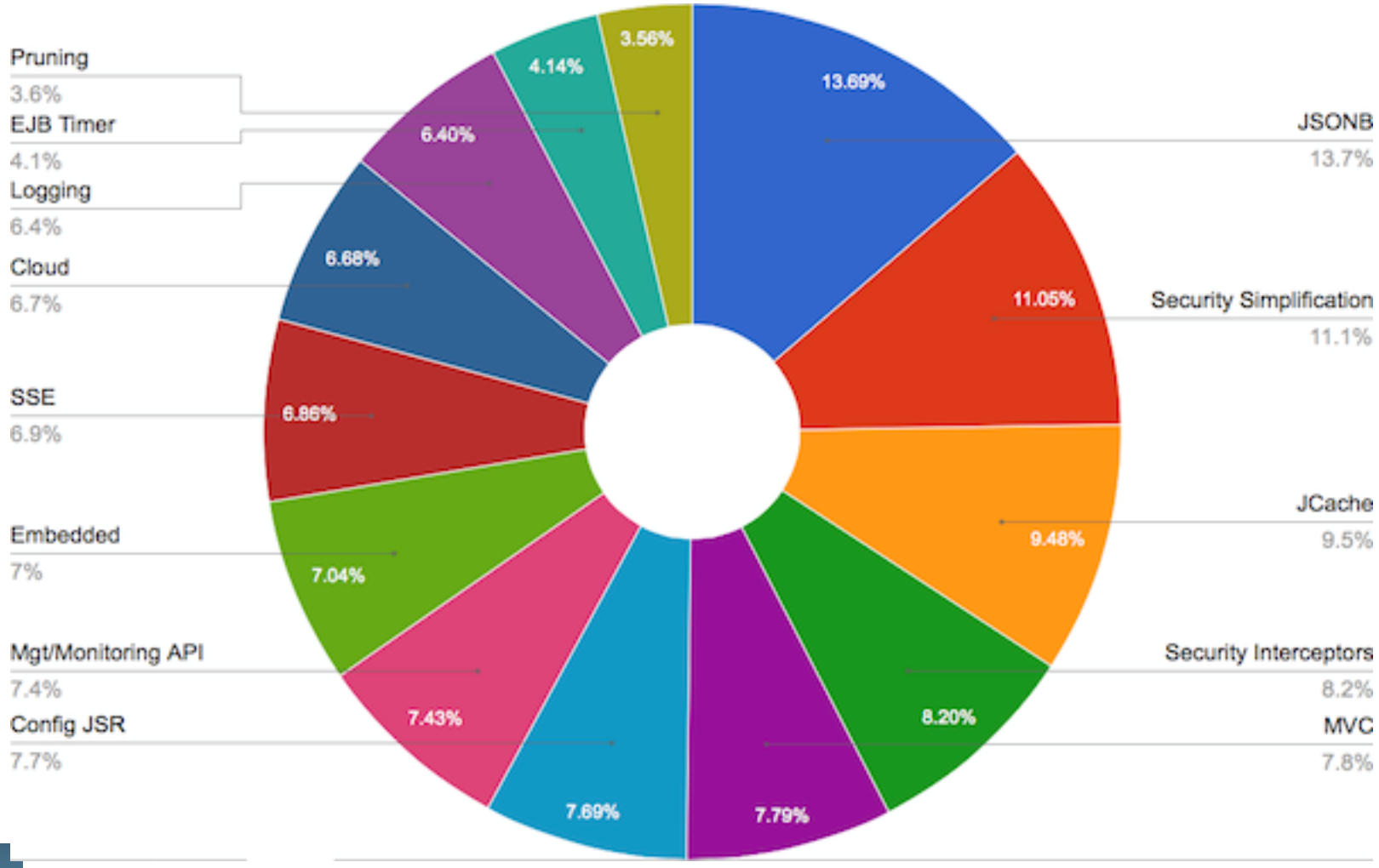
Feedback from the Community

- Many sources of input
  - Users lists of java.net projects
  - JIRAs
  - JavaOne 2013 Java EE BOF and Java EE EG meeting
  - Outreach by evangelists
- Consolidated into Community Survey

Java EE 8 Community Survey

- 3 parts over 3½ months
  - 47 questions
  - 15 fill-ins
  - 1000's of comments
- 4500+ respondents
- Prioritization of most-popular features
- https://java.net/projects/javaee-spec/downloads/download/JavaEE8_Community_Survey_Results.pdf

Community-Prioritized Features



Java EE 8 Themes

- HTML5 / Web Tier Enhancements
- Ease of Development / CDI alignment
- Infrastructure for running in the Cloud

HTML5 Support / Web Tier Enhancements

- JSON Binding
- JSON Processing enhancements
- Server-sent events
- Action-based MVC
- HTTP/2 support

JSON-B 1.0

Java API for JSON Binding

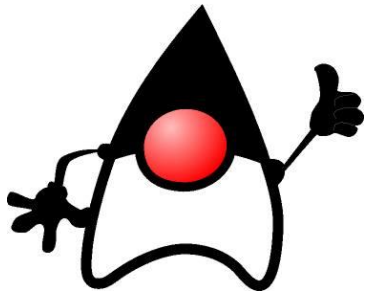
- API to marshal/unmarshal Java objects to/from JSON
  - Similar to JAXB runtime API in XML world
- Default mapping of classes to JSON
  - Annotations to customize the default mappings
  - JsonProperty, JsonTransient, JsonNillable, JsonValue, …
- Draw from best practices of existing JSON binding implementations
  - MOXy, Jackson, GSON, Genson, Xstream, …
  - Allow switch of JSON binding providers

JSON-B

```
@Entity public class Person {
  @Id String name;
  String gender;
  @ElementCollection Map<String,String> phones;
  ... // getters and setters
}

Person duke = new Person();
duke.setName("Duke");
duke.setGender("M");
phones = new HashMap<String,String>();
phones.put("home", "650-123-4567");
phones.put("mobile", "650-234-5678");
duke.setPhones(phones);
```

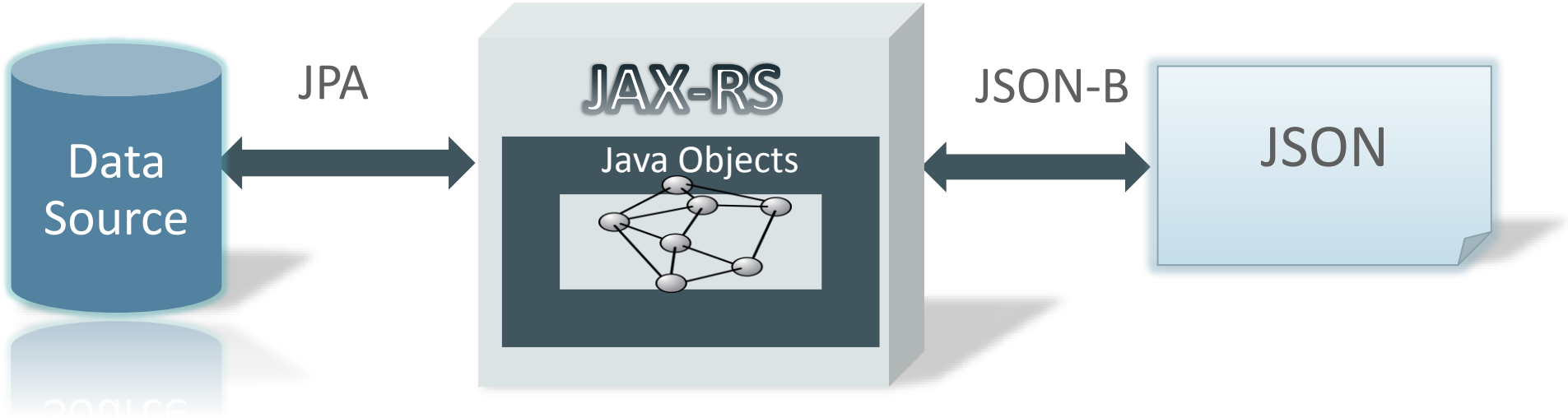
```
{
  "name":"Duke",
  "gender":"M",
  "phones":{
     "home":"650-123-4567",
     "mobile":"650-234-5678"}
}
```



```
Marshaller marshaller = new JsonContext().createMarshaller().setPrettyPrinting(true);
marshaller.marshal(duke, System.out);
```

JSON-B

- All the way from client to database
  - JSON-B will provide JAX-RS a standard way to support "application/json" media type



JSON-P 1.1

Java API for JSON Processing

- Keep JSON-P spec up-to-date
- Track new standards
- Add editing operations to JsonObject and JsonArray
- Helper classes and methods to better utilize SE 8’s stream operations

JSON-P

Tracking new standards

- JSON-Pointer – IETF RFC 6901
  - String syntax for referencing a value

    "/0/phones/mobile"

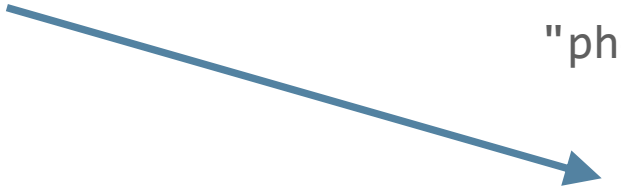
JSON-P

```
JsonArray contacts = Json.createArrayBuilder()
  .add(Json.createObjectBuilder()
     .add("name", "Duke")
     .add("gender", "M")
     .add("phones", Json.createObjectBuilder()
        .add("home", "650-123-4567")
        .add("mobile", "650-234-5678")))
  .add(Json.createObjectBuilder()
     .add("name", "Jane")
     .add("gender", "F")
     .add("phones", Json.createObjectBuilder()
        .add("mobile", "707-555-9999")))
  .build();
```

```
[
  {
    "name":"Duke",
    "gender":"M",
    "phones":{
       "home":"650-123-4567",
       "mobile":"650-234-5678"}},
  {
    "name":"Jane",
    "gender":"F",
    "phones":{
       "mobile":"707-555-9999"}}
]
```

JSON-P

```
JsonArray contacts = ...;
JsonPointer p =
    Json.createPointer("/0/phones/mobile");
JsonValue v = p.getValue(contacts);
```



```
[
 {
    "name":"Duke",
    "gender":"M",
    "phones":{
       "home":"650-123-4567",
       "mobile":"650-234-5678"}},
  {
    "name":"Jane",
    "gender":"F",
    "phones":{
       "mobile":"707-555-9999"}}
]
```

JSON-P

Tracking new standards

- JSON-Patch – IETF RFC 6902
- Patch is a JSON document
  - Array of objects / operations for modifying a JSON document
  - add, replace, remove, move, copy, test
  - Must have "op" field and "path" field

```
[
 {"op": "replace", "path":"/0/phones/mobile", "value":"650-111-2222"},
 {"op": "remove", "path":"/1"}
]
```

JSON-P

```
[
 {
  "op":"replace",
  "path":"/0/phones/mobile",
  "value":"650-111-2222"},
 {
  "op":"remove",
  "path":"/1"}
]
```

```
[
 {
    "name":"Duke",
    "gender":"M",
    "phones":{
       "home":"650-123-4567",
       "mobile":"650-234-5678"}},
  {
    "name":"Jane",
    "gender":"F",
    "phones":{
       "mobile":"707-555-9999"}}
]
```

JSON-P

```
[
 {
  "op":"replace",
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 {
  "op":"remove",
  "path":"/1"}
]
```

```
[
 {
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]
```

JSON-P

```
[
 {
  "op":"replace",
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```
[
 {
    "name":"Duke",
    "gender":"M",
    "phones":{
       "home":"650-123-4567",
       "mobile":"650-111-2222"}}
]
```

JSON-P

JSON Patch

- Issue: JsonObject and JsonArray are immutable
- Need editing capability to implement JSON patch
- Possible approach: use builder pattern
  - Builder creates mutable object for for temporary editing
  - Convert to immutable object when done

JSON-P

JSON Query using Lambda Operations

```
JsonArray contacts = ...;
List<String> femaleNames =
   contacts.getValuesAs(JsonObject.class).stream()
        .filter(x->"F".equals(x.getString("gender")))
        .map(x->(x.getString("name"))
        .collect(Collectors.toList());
```

JSON-P

JSON query collecting results in JsonArray

```
JsonArray contacts = ...;
JsonArray femaleNames =
   contacts.getValuesAs(JsonObject.class).stream()
        .filter(x->"F".equals(x.getString("gender")))
        .map(x->(x.getString("name"))
        .collect(JsonCollectors.toJsonArray());
```

Server-sent Events

- Part of HTML5 standardization
- Server-to-client streaming of text data
- Mime type is text/event-stream
- Long-lived HTTP connection
  - Client establishes connection
  - Server pushes update notifications to client
  - Commonly used for one-way transmission for period updates or updates due to events

Server-sent Events

- We evaluated several possibilities: Servlet; WebSocket; JAX-RS; standalone
  - And we polled the experts
- JAX-RS deemed most natural fit
  - Streaming HTTP resources already supported
  - Small extension
    - Server API: new media type; EventOutput
    - Client API: new handler for server side events
  - Convenience of mixing with other HTTP operations; new media type
  - Jersey (JAX-RS RI) already supports SSE

Server-sent events

JAX-RS resource class

```
@Path("tickers")
public class StockTicker {
    @Get @Produces("text/event-stream")
    public EventOutput getQuotes() {
        EventOutput eo = new EventOutput();
        new StockThread(eo).start()
        return eo;
    }
}
```

Server-sent events

JAX-RS StockThread class

```
class StockThread extends Thread {
  private EventOutput eo;
  private AtomicBoolean ab =
     new AtomicBoolean(true);

  public StockThread(EventOutput eo) {
     this.eo = eo;
  }
  public void terminate() {
     ab.set(false);
  }
```

```
@Override
public void run() {
  while (ab.get()) {
    try {
        // ...
      eo.send(new StockQuote("..."));
        // ...
     } catch (IOException e) {
        // ...
     }
   }
  }
}
```

Server-sent events

JAX-RS Client

```
WebTarget target = client.target("http://example.com/tickers");
EventSource eventSource = new EventSource(target) {
    @Override
    public void onEvent(InboundEvent inboundEvent) {
      StockQuote sq = inboundEvent.readData(StockQuote.class);
      // ...
     }
  };
eventSource.open();
```

Model View Controller (MVC)

2 Main Styles

- Component-based MVC
  - Style made popular by component frameworks
  - Controller provided by the framework
  - JSF, Wicket, Tapestry…
- Action-based MVC
  - Controllers defined by the application
  - Struts 2, Spring MVC…

MVC 1.0

- Action-based model-view-controller architecture
- Glues together key Java EE technologies:
  - Model
    - CDI, Bean Validation, JPA
  - View
    - Facelets, JSP
  - Controller
    - JAX-RS resource methods

MVC

JAX-RS controller

```
@Path("hello")
public class HelloController {
   @Inject
   private Greeting greeting;

   @GET
   @Controller
   public String hello() {
     greeting.setMessage("Hello there!");
     return "hello.jsp";
   }
}
```

MVC

Model

```
@Named("greeting")
@RequestScoped
public class Greeting{
   private String message;

   public String getMessage() { return message; }

   public void setMessage(String message) {
      this.message = message;
   }
}
```

MVC

JAX-RS controller

```
@Path("hello")
public class HelloController {
    @Inject
    private Greeting greeting;

    @GET
    @Controller
    public String hello() {
      greeting.setMessage("Hello there!");
      return "hello.jsp";
    }
}
```

MVC

View

```
<%@ page contentType="text/html;charset=UTF-8" language="java" %>
<html>
<head>
   <title>Hello</title>
</head>
<body>
<h1>${greeting.message}</h1?
</body>
</html>
```

HTTP/2

Address the Limitations of HTTP 1.x

HTTP/2 standard now formally approved by IETF

- Reduce latency
- Address the HOL blocking problem
- Support parallelism (without requiring multiple connections)
- Retain semantics of HTTP 1.1
- Define interaction with HTTP 1.x

HTTP/2

- Request/Response multiplexing over single connection
  - Fully bidirectional
  - Multiple streams
- Stream Prioritization
- Server Push
- Binary Framing
- Header Compression
- Upgrade from HTTP 1.1

Servlet 4.0

HTTP/2 Features in Servlet API

- Request/response multiplexing
  - Servlet Request as HTTP/2 message
- Stream prioritization
  - Add stream priority to HttpServletRequest
- Server push
- Binary framing
  - Hidden from API
- Upgrade from HTTP 1.1

Ease of Development / CDI Alignment

- Security interceptors
- Simplified messaging through CDI-based “MDBs”
- JAX-RS injection alignment
- WebSocket scopes
- Pruning of EJB 2.x client view and IIOP interoperability

Java EE Security 1.0

Authorization via CDI Interceptors

```
@IsAuthorized("hasRoles('Manager') && schedule.officeHrs")
void transferFunds()

@IsAuthorized("hasRoles('Manager') && hasAttribute('directReports', employee.id)")
double getSalary(long employeeId);

@IsAuthorized(ruleSourceName="java:app/payrollAuthRules", rule="report")
void displayReport();
```

JMS 2.1

New API to receive messages asynchronously

- Alternative to EJB message-driven beans
- Simpler JMS-specific annotations
- Usable by any CDI bean
- No need for MessageListener implementation

JMS MDBs Today

EJB 3.2, JMS 2.0

```
@MessageDriven(activationConfig = {
  @ActivationConfigProperty(propertyName="connectionFactoryLookup", propertyValue="jms/myCF"),
  @ActivationConfigProperty(propertyName="destinationLookup", propertyValue="jms/myQueue"),
  @ActivationConfigProperty(propertyName="destinationType", propertyValue="javax.jms.queue")})

public class MyMDB implements MessageListener {
   public void onMessage(Message message) {
       // extract message body
       String body = message.getBody(String.class));
       // process message body
   }
}
```

Any Java EE bean as a listener

JMS 2.1

```
@RequestScoped
public class MyListenerBean {
   @JMSListener(destinationLookup="jms/myQueue")
   @Transactional
   public void myCallback(Message message) {
   ...
   }
}
```

Pruning

EJB 2.x Client View

```
public interface PayrollHome
   extends javax.ejb.EJBLocalHome {
     public Payroll create()
        throws CreateException;
    ...
   }
public interface Payroll
    extends javax.ejb.EJBLocalObject {
     public double getSalary(int empId);
    ...
   }
```

```
public interface Payroll {
    public double getSalary(int EmpId);
    ...
}
```

Modernize the Infrastructure

For On-Premise and for in the Cloud

- Java EE Management 2.0
  - REST-based APIs for Management and Deployment
- Java EE Security 1.0
  - Authorization
  - Password Aliasing
  - User Management
  - Role Mapping
  - Authentication
  - REST Authentication

Java EE Management 2.0

- Update to JSR 77 (J2EE Management)
- REST-based interfaces to augment (or replace) current Management EJB APIs
  - Currently used OBJECT_NAME to become URL
  - Define CRUD operations over individual managed objects
  - Server-sent events used for event support
- Simple deployment interfaces also to be considered as part of management API

Java EE Security 1.0

Candidate Areas to Enhance Portability, Flexibility, Ease-of-Use

- Password Aliasing
- User Management
- Role Mapping
- Authentication
- REST Authentication
- Authorization

Java EE Security 1.0

Password Aliasing

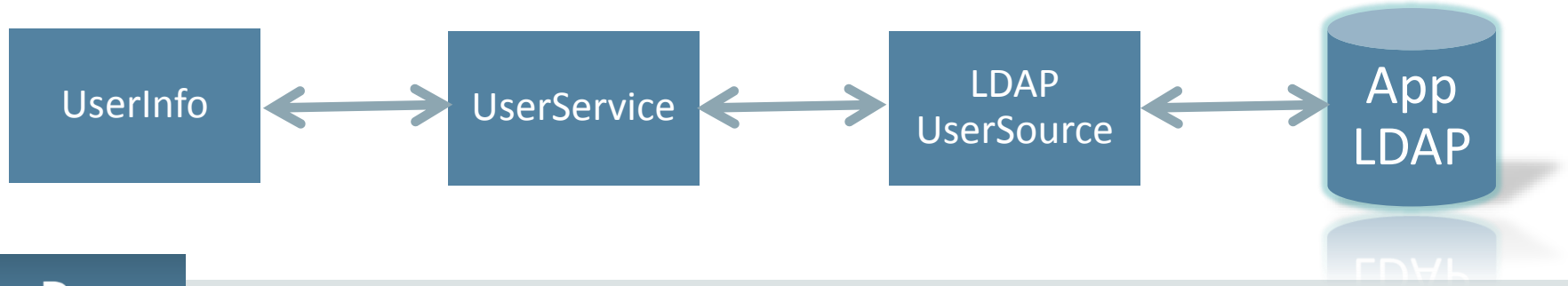
- Standardized syntax for password aliases
  - Avoids storing passwords in clear text in code, deployment descriptors, files
-
```
@DataSourceDefinition(
    name="java:app/MyDataSource",
    className="com.example.MyDataSource",
    ...
    user="duke",
    password="${ALIAS=dukePassword}")
```

- Standardized secure credentials archive for bundling alias and password with app
  - Used by platform as credential store for resolving alias

Java EE Security 1.0

User Management

- Allow application to manage its own users and groups
  - Without need to access server configuration
- Users stored in application-specified repository (e.g., LDAP)
- User service manipulates users from user source



Java EE Security 1.0

User Management

- UserSourceDefinition
- UserService
  - Create/delete users, create/delete groups, add user to group, load UserInfo by user name; etc…
- UserInfo
  - get user name, password, get user's roles, get user's attributes, …

Java EE Security 1.0

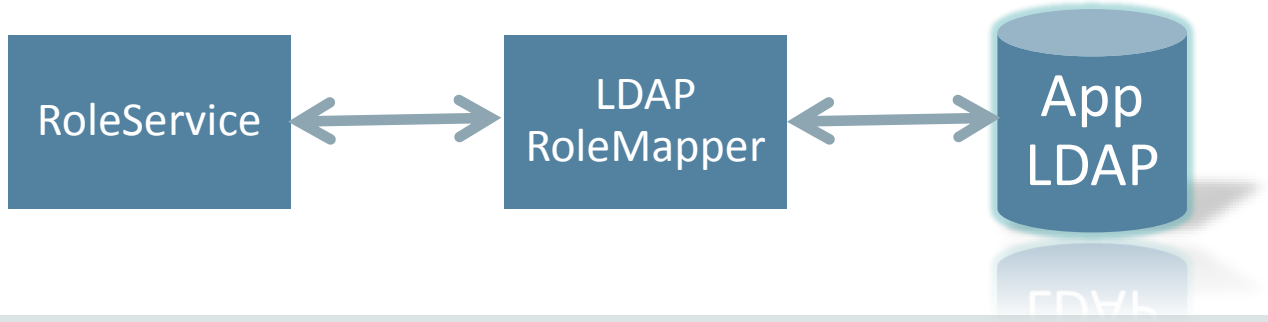
User Management

```
@LdapUserSourceDefinition(
  name="java:app/ldapUserSource",
  ldapUrl="ldap://someURL",
  ldapUser="ElDap",
  ldapPassword="${ALIAS=LdapPW}",
  ...
)
public class MyAuthenticator {
  @Resource(lookup="java:app/ldapUserSource")
  private UserService userService;
  private boolean isAccountEnabled(String username) {
    return userService.loadUserByUsername(username).isEnabled();
  }
  ...
}
```

Java EE Security 1.0

Role Mapping

- Standardize role service
  - Role mappings can be stored in app-specified repository (e.g., LDAP)
  - Application can assign roles to users and groups, based on application-specific model
  - Without need to access server configuration



Java EE Security 1.0

Role Mapping

- RoleMapperDefinition
  - DataSource, Ldap, Memory/File, Custom, predefined
- RoleService
  - grant/revoke roles for user/group, get roles for user/group, ...

```
@Resource(lookup="java:app/devRoleMapper")
RoleService roleService;
List<String> getRoles(String username) {
   return roleService.getRolesForUser(username);
}
```

Java EE 8 JSRs

- Java EE 8 Platform (JSR 366)
- CDI 2.0 (JSR 365)
- JSON Binding 1.0 (JSR 367)
- JMS 2.1 (JSR 368)
- Java Servlet 4.0 (JSR 369)
- JAX-RS 2.1 (JSR 370)
- MVC 1.0 (JSR 371)
- JSF 2.3 (JSR 372)
- Java EE Management 2.0 (JSR 373)
- JSON-P 1.1 (JSR 374)
- Java EE Security 1.0 (JSR 375)
- … and more to follow …

Expected MRs and small JSRs

- EL
- Concurrency Utilities
- Connector Architecture
- WebSocket
- Interceptors
- JPA
- EJB
- JTA
- JCache
- Bean Validation
- Batch
- JavaMail
- … and more to follow …

Transparency

Commitment to JCP transparent processes

- Our Java EE 8 JSRs run in the open on java.net
  - http://javaee-spec.java.net
  - One project per JSR – jax-rs-spec, mvc-spec, servlet-spec,…
- Publically viewable Expert Group mail archive
  - Users observer lists gets all copies
- Publicly accessible download area
- Publicly accessible issue tracker / JIRA
- …

How to Get Involved

- Adopt a JSR
  - http://glassfish.org/adoptajsr
- Join an Expert Group project
  - http://javaee-spec.java.net
  - https://java.net/projects/javaee-spec/pages/Specifications
- The Aquarium
  - http://blogs.oracle.com/theaquarium
- Java EE 8 Reference Implementation
  - http://glassfish.org

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