JBoss WORLD CHICAGO 2009

JSR-299 Contexts and Dependency and Dependency Injection for Java EE

Gavin King & Pete Muir

presented by

Road Map

- Background
- Concepts
- Status

Java EE 6

- The EE 6 web profile removes most of the “cruft” that has developed over the years
  - mainly useless stuff like web services, EJB 2 entity beans etc.
  - some useful stuff (e.g. JMS) is missing, **but** vendors can include it
- EJB 3.1 - a whole bunch of cool new functionality!
- JPA 2.0 - typesafe criteria API, many more O/R mapping options
- JSF 2.0 - Ajax, easy component creation, bookmarkable URLs
- Bean Validation 1.0 - annotation-based validation API
- Servlet 3.0 - async support, better support for frameworks
- Standard global JNDI names
- Managed Beans

Managed Beans

- Container-managed POJOs with minimal requirements
- support a set of basic services
  - resource injection
  - lifecycle callbacks
  - interceptors
- the foundation for all other component types in the platform
  - core services centralized under Managed Beans
  - Other specifications will add support for additional services
    - remoting
    - instance pooling
    - web services

Goals

- JSR-299 defines a unifying dependency injection and contextual lifecycle model for Java EE 6
  - a completely new, richer dependency management model
  - designed for use with stateful objects
  - integrates the “web” and “transactional” tiers
  - makes it much easier to build applications using JSF and EJB together
  - includes a complete SPI allowing third-party frameworks to integrate cleanly in the EE 6 environment

Loose coupling

- Decouple server and client
  - Using well-defined types and “qualifiers”
  - Allows server implementation to vary
- Decouple life cycle of collaborating components
  - Automatic contextual life cycle management
  - Stateful components interact like services
- Decouple orthogonal concerns (AOP)
  - Interceptors
  - Decorators
- Decouple message producer from message consumer
  - Events

Strong typing

- Eliminate reliance on string-based names
- Compiler can detect typing errors
  - No special authoring tools required for code completion
  - Casting virtually eliminated
- Report errors early
  - At deployment
  - Tooling can give prevent ambiguous dependencies

Going beyond the spec

- Web Beans provides extra integrations
  - Tomcat/Jetty support
  - Java SE support
  - OSGi containers
  - ???
- and features which can be used in any JSR-299 environment
  - Seam2 bridge
  - Spring bridge
  - Wicket support
  - ???

Seam 3?

- Use the JSR-299 core
- Provide a development environment
  - JBoss Tools
  - Seam-gen (command line tool)
- include a set of modules for any container which includes JSR-299
  - jBPM integration
  - Seam Security
  - Reporting (Excel/PDF)
  - Mail
  - etc.

Road Map

- Background
- Concepts
- Status

Essential ingrediants

- API types
- Qualifier annotations
- Scope
- Alternative
- A name (optional)
- Interceptor bindings
- The implementation

Simple Example

```
public class Hello {
    public String sayHello(String name) {
        return "hello" + name;
    }
}
```

Any Managed Bean can use these services

```
@Stateless
public class Hello {
    public String sayHello(String name) {
        return "hello" + name;
    }
}
```

So can EJBs

Simple Example

```
public class Printer {

    @Inject Hello hello;

    public void printHello() {
        System.out.println( hello.sayHello("world") );
    }
}
```

`@Inject` defines an injection point.
`@Default` qualifier is assumed

Constructor injection

```
public class Printer {
    private Hello hello;

    @Inject
    public Printer(Hello hello) { this.hello=hello; }

    public void printHello() {
        System.out.println( hello.sayHello("world") );
    }
}
```

Mark the constructor to be called by the container `@Inject`

Constructors are injected by default; `@Default` is the default qualifier

Web Bean Names

```
@Named("hello")
public class Hello {
    public String sayHello(String name) {
        return "hello" + name;
    }
}
```

By default not available through EL.

```
@Named
public class Hello {
    public String sayHello(String name) {
        return "hello" + name;
    }
}
```

If no name is specified, then a default name is used. Both these Managed Beans have the same name

JSF Page

```
<h:commandButton value="Say Hello"
                 action="#{hello.sayHello}"/>
```

Calling an action on a bean through EL

Qualifiers

A qualifier is an annotation that lets a client choose between multiple implementations of an API at runtime

Defining a qualifier

```
@Qualifer
@Retention(RUNTIME)
@Target({TYPE, METHOD, FIELD, PARAMETER})
public @interface Casual {}
```

Creating a qualifier is really easy!

Using a qualifier

```
@Casual
public class Hi extends Hello {
    public String sayHello(String name) {
        return "hi" + name;
    }
}
```

We also specify the `@Casual` qualifier. If no qualifier is specified on a bean, `@Default` is assumed

Using a qualifier

```
public class Printer {
    @Inject @Casual Hello hello;
    public void printHello() {
        System.out.println( hello.sayHello("JBoss") );
    }
}
```

Here we inject the `Hello` bean, and require an implementation which is qualified by `@Casual`

Alternatives

- An alternative bean is one which must be specifically enabled for a particular deployment
  - It replaces the managed or session bean for which it is an alternative
  - May also completely replace it
    - all producers and observers defined on original bean are disabled for this deployment)
  - Alternatives enabled in XML deployment descriptor

Defining an alternative

```
@Alternative
public class Hola extends Hello {

   public String sayHello(String name) {
      return "hola " + name;
   }

}
```

Same API, different implementation

Enabling an alternative

```
<beans>
  <alternatives>
    <class>com.acme.Hola</class>
    <sterotype>com.acme.SouthernEuropean</stereotype>
  </alternatives>
</beans>
```

Can also define a sterotype as an alternatives. Any stereotyped beans will be an alternative

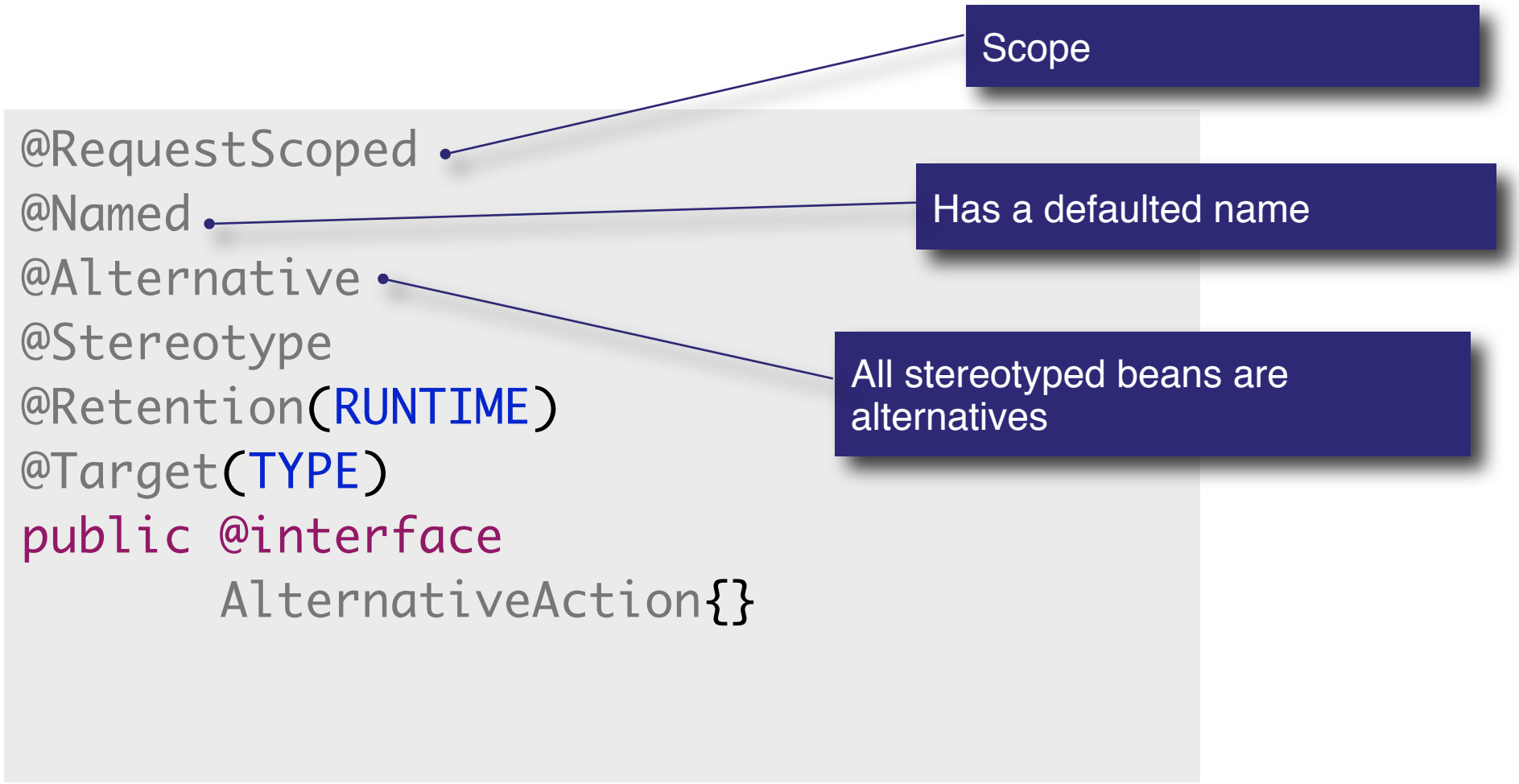
Stereotypes

- We have common architectural “patterns” in our application, with recurring roles
  - Capture the roles using stereotypes

Stereotypes

- A stereotype encapsulates any combination of:
  - a default scope, and
  - a set of interceptor bindings.
- A stereotype may also specify that:
  - all beans with the stereotype have defaulted bean EL names
  - all beans with the stereotype are alternatives

Creating a stereotype



Using a stereotype

```
@AlternativeAction
public class Hello {
    public String sayHello(String name) {
        return "hi " + name;
    }
}
```

Scopes and Contexts

- Built-in scopes:
  - Any servlet - `@ApplicationScoped`, `@RequestScoped`, `@SessionScoped`
  - JSF requests - `@ConversationScoped`
- Dependent scope: `@Dependent`
- Custom scopes
  - A scope type is an annotation, can write your own context implementation and scope type annotation

Scopes

```
@SessionScoped
public class Login {
    private User user;
    public void login() {
        user = ...;
    }
    public User getUser() { return user; }
}
```

Session scoped

Scopes

```
public class Printer {

   @Inject Hello hello;
   @Inject Login login;

   public void printHello() {
      System.out.println(
         hello.sayHello( login.getUser().getName() ) );
   }
}
```

No coupling between scope and use of implementation

Producer methods

- Producer methods allow control over the production of a bean where:
  - the objects to be injected are not managed instances
  - the concrete type of the objects to be injected may vary at runtime
  - the objects require some custom initialization that is not performed by the bean constructor

Producer methods

```
@SessionScoped
public class Login {
   private User user;
   public void login() {
      user = ...;
   }

   @Produces
   User getUser() { return user; }
}
```

Producer methods

```
public class Printer {
   @Inject Hello hello;
   @Inject User user;
   public void hello() {
      System.out.println(
         hello.sayHello( user.getName() ) );
   }
}
```

Much better, no dependency on Login!

Producer Fields

- Simpler alternative to Producer methods

```
@SessionScoped
public class Login {

   @Produces @LoggedIn @RequestScoped
   private User user;

   public void login() {
      user = ...;
   }
}
```

Similar to outjection in Seam

Disposal Method

- Clean up after a producer method

```
public class UserDatabaseEntityManager {

    @Produces @UserDatabase
    EntityManager create(EntityManagerFactory emf) {
        return emf.createEntityManager();
    }

    void close(@Disposes @UserDatabase EntityManager em) {
    em.close();
    }
}
```

Same API type

Same qualifier

Java EE Resources

- To inject Java EE resources, persistence contexts, web service references, remote EJB references, etc, we use a special kind of producer field declaration:

```
public class PricesTopic {
    @Produces @Prices
    @Resource(name="java:global/env/jms/Prices")
    Topic pricesTopic;
}
```

```
public class UserDatabasePersistenceContext {
    @Produces @UserDatabase
    @PersistenceContext
    EntityManager userDatabase;
}
```

Events

- Event producers raise events that are then delivered to event observers by the Web Bean manager.
  - not only are event producers decoupled from observers; observers are completely decoupled from producers
  - observers can specify a combination of "selectors" to narrow the set of event notifications they will receive
  - observers can be notified immediately, or can specify that delivery of the event should be delayed until the end of the current transaction

Event producer

```
public class Hello {

   @Inject @Any Event<Greeting> greeting;

   public void sayHello(String name) {
      greeting.fire( new Greeting("hello " + name) );
   }

}
```

Inject an instance of `Event`. Additional qualifiers can be specified to narrow the event consumers called. API type specified as a parameter on `Event`

"Fire" an event, the producer will be notified

Event consumer

```
public class Printer {

   void onGreeting(@Observes Greeting greeting,
                   User user) {
      System.out.println(user + " says " + greeting);
   }

}
```

Observer methods, take the API type and additional qualifiers

Additional parameters can be specified and will be injected by the container

Road Map

- Background
- Concepts
- Status

JSR-299

- Proposed Final Draft published
- Proposed Final Draft 2 in draft form
- Web Beans “Book” (a less formal guide to JSR299)
  - http://www.seamframework.org/WebBeans
  - look for an update soon!
- Send feedback to jsr-299-comments@jcp.org

Web Beans

- The Reference implementation
- Feature complete preview of second public review draft. Download it, try it out, give feedback!
  - http://seamframework.org/Download
- Working on first release candidate of the final draft (expected mid September)

Web Beans

- Integrated into:
  - JBoss 5.1.0 and above
  - GlassFish V3 build 46 and above
- Available as an addon for:
  - Tomcat 6.0.x
  - Jetty 6.1.x

Q & A

http://in.relation.to/Bloggers/Pete

http://in.relation.to/Bloggers/Gavin

http://www.seamframework.org/WebBeans

http://jcp.org/en/jsr/detail?id=299