An Introduction to Seam 3

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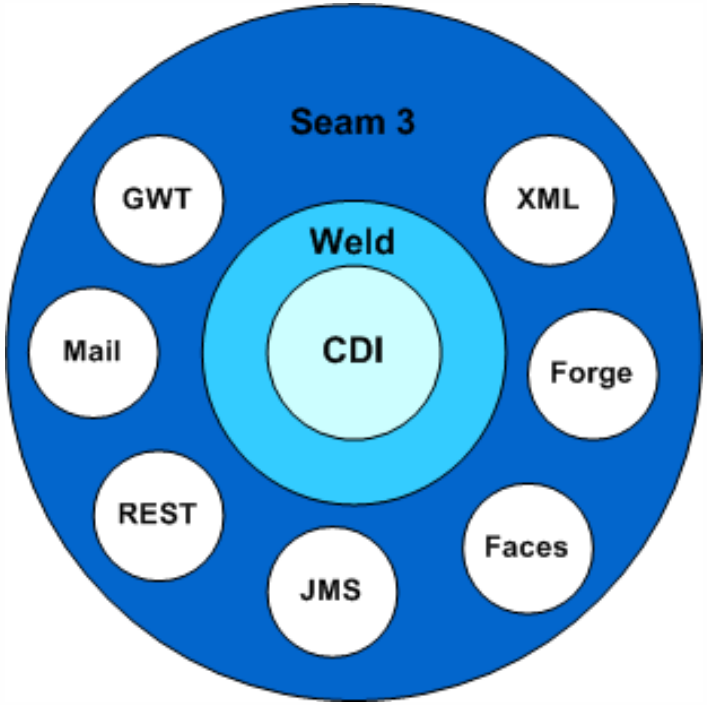
CDI, Weld and Seam 3

- **CDI is the dependency injection standard for Java EE**
- **Weld is the reference implementation of CDI**
- **Seam 3 is a set of CDI portable extension modules**



Contexts and Dependency Injection for Java EE (CDI)

CDI Overview

- **Next-generation dependency injection for Java EE**
- **Also known as JSR-299, formerly known as WebBeans**
- **Synthesizes best ideas from Seam 2, Guice and Spring**
- **Many innovative features on its own right**
- **Focus on loose-coupling, Java-centric type-safety, annotations, expressiveness and ease-of-use**
- **Makes Java EE much more flexible, testable, pluggable and extensible**

CDI Features

- **Basic dependency injection**
  - **@Inject, @Qualifier, @Stereotype, @Alternative, Instance, @All, @Any**
- **Component naming**
  - **@Named**
- **Context management**
  - **@Dependent, @RequestScoped, @SessionScoped, @ConversationScoped, @ApplicationScoped, @Scope**

CDI Features

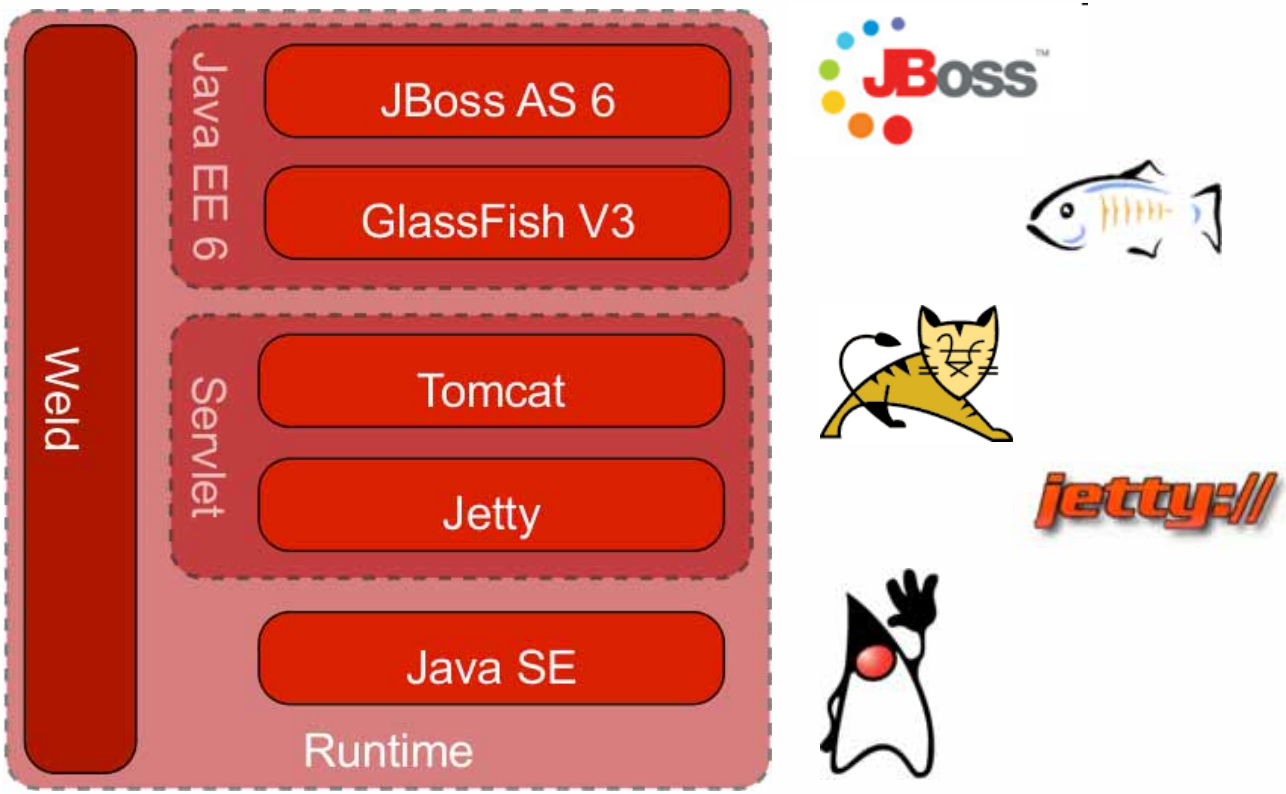
- **Custom Object Factories**
  - **@Produces, @Disposes, InjectionPoint**
- **Lightweight Events**
  - **Event, @Observes**
- **Interceptors/Decorators**
  - **@Interceptor, @InterceptorBinding, @AroundInvoke, InvocationContext, @Decorator, @Delegate**
- **Portable extensions SPI***

JBoss Weld

Weld Overview

- **CDI reference implementation and compatibility test kit from JBoss**
- **Included in GlassFish and JBoss AS**
- **Can be used with Tomcat, Jetty**
- **Can be used in Java SE**

Weld Runtime Environments



Weld Event Based Java SE Bootstrap

```
@Singleton
public class AlertListener {
  ...
  public void init(
      @Observes ContainerInitialized event,
      @Parameters List<String> parameters) {
    showSplash();
    setupUi();
    showUi(parameters);
  }
  ...
}
```

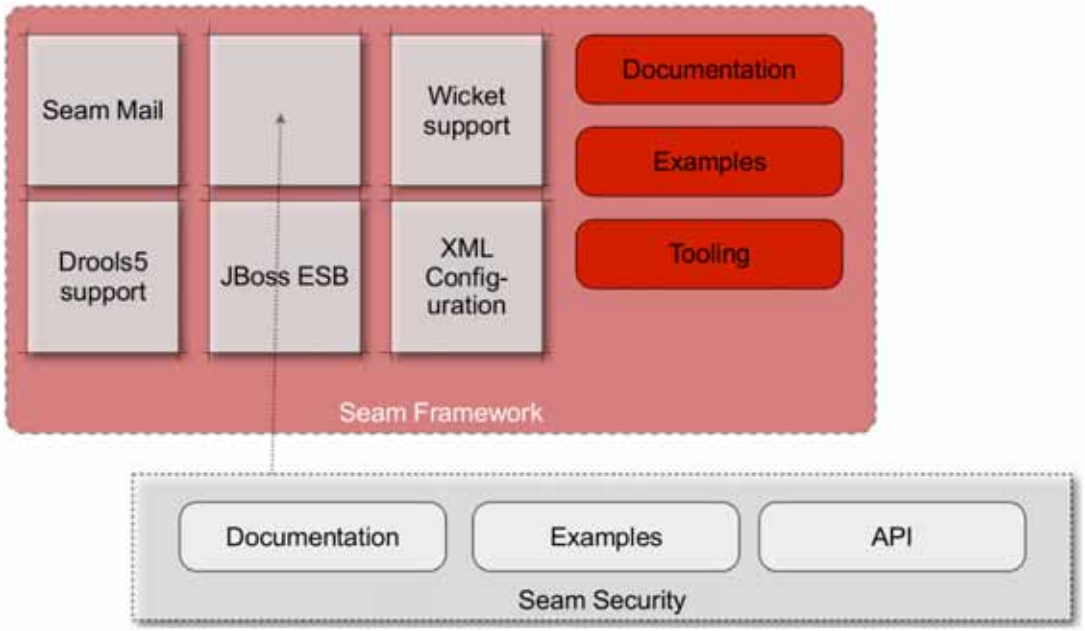
Weld Java SE Programmatic Bootstrap

```
public static void main(String[] arguments) {
  WeldContainer weld = new Weld().initialize();

  weld.instance().select(
    AlertListenerBean.class).startListening();

  weld.shutdown();
}
```

JBoss Seam 3

Seam 3

- **Set of CDI portable extensions independent of Weld**
- **Each module developed separately**
- **There are Seam “umbrella” releases**



Seam Modules

Module	Description
Solder	General enhancements to CDI
XML Configuration	XML configuration for managed beans
Persistence	Transactions and persistence for non-EJB managed beans
Faces	JSF enhancements
Servlet	Servlet enhancements
JMS	JMS integration
REST	REST enhancements
Remoting	JavaScript remoting of managed beans

Seam Modules

Module	Description
Catch	Exception handling framework
International	Internationalized/localized locale, time, messages
Security	Higher level security API for Java EE
Mail	JavaMail integration
Cron	CDI based scheduling
Document	Document generation (PDF, Excel)
Seam 2	Seam 2 backwards compatibility
Spring	Spring interoperability

Seam Modules

Module	Description
Wicket	Wicket Integration
GWT	GWT integration
Drools	Drools integration
jBPM	jBPM integration
JBoss ESB	JBoss ESB integration
Clouds	Cloud frameworks integration (JClouds, Infinispan)
Forge	Rapid application development for Java EE

Solder

- **Used to be part of Weld, good laboratory for CDI.next**
- **Generally useful CDI extensions for application, plug-in and framework developers**
- **Logging**
- **Injecting EL expression evaluator**
- **Extended resource loading**
- **Extended APIs for injection, naming, management**
- **Annotation processing and reflection utilities**

Logging

```
@MessageLogger
public interface AccountLog {
   ...
   @LogMessage
   @Message(“Account %s was overdrawn by %10.2f")
   public void overdrawn(String accountNumber,
            double amount);
   ...
}

@Inject @Category(“accounts") @Locale("en_GB")
AccountLog log;

log.overdrawn(account.getNumber(), amount);
```

Programmatic EL Evaluation

```
@Inject
private Expressions expressions;
...
Customer customer  =
    expressions.evaluateValueExpression(
        "#{account.customer}");
...
Double interest =
    expressions.evaluateMethodExpression(
        "#{account.calculateMonthlyInterest}");
```

Enhanced Resource Handling

```
@Inject
@Resource("WEB-INF/beans.xml")
private URL beansXml;

@Inject
@Resource("WEB-INF/web.xml")
private InputStream webXml;

@Inject
@Resource("META-INF/aws.properties")
private Properties awsProperties;
```

XML Configuration

- **CDI Focuses mainly on annotations, not XML**
- **XML configuration is sometimes needed or preferred**
- **Seam XML configuration allows portable CDI XML configuration across implementations**
- **More compact, schema-driven and type-safe than traditional XML configuration**
- **Likely candidate for CDI.next**

Seam XML Configuration

```
public class MailSender {
  ...
  public void setEmail(String email) {
    ...
  }
  ...
}

@Qualifier
@Retention(RetentionPolicy.RUNTIME)
@Target({ ElementType.FIELD, ElementType.METHOD })
public @interface Admin {}

@Qualifier
@Retention(RetentionPolicy.RUNTIME)
@Target({ ElementType.FIELD, ElementType.METHOD })
public @interface Support {}
```

XML Object (Re)-Wiring

```
<beans xmlns="http://java.sun.com/xml/ns/javaee"
       xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
       xmlns:seam="urn:java:seam:core"
       xmlns:acme="urn:java:com.acmebank">
  ...
  <acme:MailSender>
    <seam:ApplicationScoped/>
    <acme:Admin/>
    <acme:email>admin@acmebank.com</acme:email>
  </test:MailSender>
  <acme:MailSender>
    <seam:ApplicationScoped/>
    <acme:Support/>
    <acme:email>support@acmebank.com</acme:email>
  </test:MailSender>
  ...
</beans>
```

Injecting XML-Wired Objects

```
public class CustomerSupportService {
   ...
   @Inject
   @Support
   private MailSender mail;
   ...
   mail.send();
   ...
}
```

Refining Beans with XML

```
@ApplicationScoped
public class CurrencyConverter {
  ...
  private String currency = “us-dollar”;
  private int precision = 2;
  ...
}

<acme:CurrencyConverter currency=“pound-sterling”>
  <s:modifies/>
  <!-- <s:replaces/> -->
  <acme:precision>4</acme:precision>
</acme:CurrencyConverter>
```

Seam Persistence

- **EJB transactions in CDI managed beans instead of EJB beans**
- **JPA bootstrap to work with Seam Persistence**
- **Likely standardized in Java EE 7**

Persistence and Transactions in Seam

```
@ApplicationScoped
@TransactionAttribute(
    TransactionAttributeType.REQUIRED)
@Audited
public class DefaultAccountService
    implements AccountService {
  @Inject
  private EntityManager entityManager;

  public void addAccount(Account account) {
    ...
  }
  ...
}
```

Seam Faces

- CDI Enhancements for JSF 2
- More CDI scopes to match JSF 2: `@ViewScoped`, `@RenderedScoped`, `@FlashScoped`
- Cross-field validation, page pre-load processing
- `@*Scoped` and `@Inject` in Validators and Converters
- Injecting Faces objects
- Bridging CDI Events with the JSF life-cycle
- Likely standardized in Java EE 7

Cross-Field Validation Form

```
<h:form id="locationForm">
  <h:inputText id="city" value="#{bean.city}"/>
  <h:inputText id="state" value="#{bean.state}"/>
  <h:inputText id="zip" value="#{bean.zip}"/>
  <h:commandButton id="submit" value="Submit“
      action="#{bean.submit}"/>
  <seam:validateForm
      validatorId="locationValidator"/>
</h:form>
```

Cross-Field Validator

```
@FacesValidator @RequestScoped
public class LocationValidator implements Validator {
  ...
  private @Inject Directory directory;

  private @Inject @InputField String city;
  private @Inject @InputField String state;
  private @Inject @InputField String zip;
  ...
  public void validate(FacesContext context, UIComponent
      component, Object values) throws ValidatorException {
    if (!directory.exists(city, state, zip))
      throw new ValidatorException(
          new FacesMessage(“Invalid location, try again"));
  }
}
```

JSF Pre-Load

```
<f:metadata>
  <f:viewParam name="id"
      value="#{accountManager.accountId}"/>
  <s:viewAction
      action="#{accountManager.loadAccount}"/>
</f:metadata>
```

JSF Object Injection

```
@Inject FacesContext facesContext;
@Inject ExternalContext externalContext;
@Inject NavigationHandler navigationHandler;
@Inject Flash flash;
```

Seam JMS

- **Injecting connections, sessions, queues, topics, message producers, message receivers**
- **CDI Event Observers as JMS message listeners**
- **CDI Events sent to JMS destinations**
- **Some features could be standardized in Java EE 7**

Seam JMS Resource Injection

```
public class TransferSender {
  ...
  @Inject
  @JmsSession(
      transacted=true,
      acknowledgementType=Session.AUTO_ACKNOWLEDGE)
  private Session session;

  @Inject
  @JmsDestination(jndiName="jms/TransferQueue")
  private MessageProducer producer;
  ...
  public void sendTransfer(Transfer transfer) {
    ...
    producer.send(session.createObjectMessage(transfer));
    ...
  }
  ...
}
```

Catch

- **Event-based exception handling framework**
- **Automatic exception chain handling**
- **Type-based handler callback hierarchy**

Exception Handler

```
@HandlesExceptions
public class IOExceptionHandler {
  ...
  public void handleIOExceptions(
      @Handles CaughtException<IOException> event) {
    System.out.println(“I/O Problem: " +
        event.getException().getMessage());
   }
   ...
}
```

Seam REST

- **Configure exception handling rules**
- **Integrate with Seam Catch**
- **Integrate Bean Validation with JAX-RS**
- **Templates for JAX-RS output**
- **RESTEasy client integration**
- **Some features could be standardized in Java EE 7**

Seam REST Exception Mapping

```
<rest:SeamRestConfiguration>
  <rest:mappings>
    <seam:value>
      <exceptions:Mapping
          exceptionType="javax.persistence.NoResultException"
          statusCode="404">
        <exceptions:message>
          Resource does not exist.
        </exceptions:message>
      </exceptions:Mapping>
    </s:value>
    <s:value>
      <exceptions:Mapping
          exceptionType="java.lang.IllegalArgumentException"
          statusCode="400">
        <exceptions:message>Illegal value.</exceptions:message>
      </exceptions:Mapping>
    </s:value>
  </rest:mappings>
</rest:SeamRestConfiguration>
```

Seam REST Bean Validation

```
@Stateless
@Path("/bid")
public class DefaultBidService implements BidService
{
  ...
  @POST
  @Consumes("text/xml")
  @ValidateRequest
  public void addBid(Bid bid) {
    ...
  }
  ...
}
```

Seam REST Output Templates

```
@GET
@Produces({ "application/json",
            "application/categories+xml",
            "application/categories-short+xml" })
@ResponseTemplate.List({
  @ResponseTemplate(
      value="/freemarker/categories.ftl",
      produces = "application/categories+xml"),
  @ResponseTemplate(
      value="/freemarker/categories-short.ftl",
      produces = "application/categories-short+xml")})
public List<Category> getCategories() {
```

Seam RESTEasy Client

```
@Inject
@RestClient("http://services.actionbazaar.com/bid")
private BidService bidService;
...
bidService.addBid(bid);
```

Seam Remoting

- **Export CDI beans to AJAX via remoting**
- **RPC and domain object models of remoting**
- **Remote context**
- **Client-side bean validation**

Seam Remoting on the Server

```
@Named("bidService")
@Stateless
public class DefaultBidService implements BidService
{
  ...
  @WebRemote
  public void addBid(String bidder, String item,
      Double amount) {
    ...
  }
  ...
}
```

Seam Remoting on the Client

```
<script type="text/javascript">
  function addBid() {
    ...
    Seam.createBean(“bidService").addBid(bidder,
        item, amount);
    ...
  }
</script>

<button onclick="javascript:addBid()">Bid!</button>
```

Seam Servlet

- **Bridging CDI Events with the Servlet life-cycle**
- **Injecting Servlet objects**
- **Integration with Seam Catch**
- **Some features could be standardized in Java EE 7**

Servlet Life-Cycle as CDI Events

```
public void onServletContextInitialization(
    @Observes @Initialized ServletContext context) {
  ...
}

public void onSessionInitialization(
    @Observes @Initialized HttpSession session) {
  ...
}

public void onRequestInitialization(
    @Observes @Initialized @Path(“/bid")
        HttpServletRequest request) {
  ...
}
```

Servlet Object Injection

```
@Inject ServletConfig configuration;
@Inject ServletContext context;
@Inject HttpSession session;
@Inject HttpServletRequest request;
@Inject @RequestParam("id") String bidId;
@Inject @HeaderParam("User-Agent") String userAgent;
@Inject HttpServletResponse response;
@Inject List<Cookie> cookies;
```

International

- **Managing locale/time-zone for the application or session**
- **Internationalized, localized messages**

Getting and Setting Default Locale

```
@Inject Locale defaultLocale;
@Inject DateTimeZone defaultTimeZone;

<locale:DefaultLocaleProducer>
  <seam:specializes/>
  <locale:defaultLocaleKey>
    en_US
  </locale:defaultLocaleKey>
</locale:DefaultLocaleProducer>
<timezone:DefaultTimeZoneProducer>
  <s:specializes/>
  <timezone:defaultTimeZoneId>
    America/New_York
  </timezone:defaultTimeZoneId>
</timezone:DefaultTimeZoneProducer>
```

Getting and Setting User Locale

```
@Inject @UserLocale Locale userlocale;
@Inject @UserTimeZone DateTimeZone userTimeZone;

@Inject @Changed Event<Locale> localeEvent;
@Inject @Changed Event<DateTimeZone> timeZoneEvent;

public void setUserLocale() {
  localeEvent.fire(Locale.CANADA);
}

public void setUserTimeZone() {
  timeZoneEvent.fire(
      DateTimeZone.forID("America/Vancouver"));
}
```

Summary

- **CDI next generation dependency injection for Java EE**
- **Weld reference implementation from JBoss included in GlassFish and JBoss AS**
- **Seam a large set of CDI portable extensions**
- **Logging, XML, RAD, persistence/tx, JSF, JMS, JAX-RS, JavaScript remoting, security, i18n & l10n, JavaMail, scheduling, documents, Servlet, Spring, Wicket, GWT, Drools, jBPM, JBoss ESB, exceptions, cloud**
- **More on the way!**

References

- **JSR 299: Contexts and Dependency Injection for Java EE, http://jcp.org/en/jsr/detail?id=299**
- **Weld, the JBoss reference implementation for JSR 299, http://seamframework.org/Weld**
- **Seam 3, http://seamframework.org**

Thanks!

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