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Java EE 7:
What's New in the Java EE Platform

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Program Agenda

A look at some of the important new features of Java EE 7

Java EE 7 Themes

- More annotated POJOs
- Less boilerplate code
- Cohesive integrated platform

- WebSockets
- JSON
- Servlet 3.1 NIO
- REST

- Batch
- Concurrency
- Simplified JMS

Java EE 7 JSRs
New or Updated

- JPA 2.1
- JAX-RS 2.0
- EJB 3.2
- JMS 2.0
- Servlet 3.1
- EL 3.0
- JSF 2.2
- CDI 1.1
- Bean Validation 1.1
- WebSocket 1.0
- JSON 1.0
- Batch Applications 1.0
- Concurrency Utilities 1.0

Java EE 7 Maintenance Releases

- Common Annotations 1.2
- JTA 1.2
- Interceptors 1.2
- Connector 1.7
- JSP 2.3
- JASPIC 1.2
- JACC 1.4
- JavaMail 1.5
- Web Services 1.4

JSON Processing 1.0

- API to parse and generate JSON
- Streaming API (javax.json.stream)
  - Low-level, efficient way to parse/generate JSON
  - Similar to StAX API in XML world
- Object model API (javax.json)
  - Simple, easy to use high-level API
  - Similar to DOM API in XML world

JSON Processing 1.0

Streaming API: Parsing

- Created using
  - Json.createParser(…)
  - Json.createParserFactory().createParser(…)
- Parses JSON in streaming way from input sources

```
Event event = parser.next();   //START_OBJECT
event = parser.next();         // KEY_NAME
event = parser.next();         // VALUE_STRING
```

- Parser state events
  - START_OBJECT, END_OBJECT, START_ARRAY, END_ARRAY, KEY_NAME, VALUE_STRING, VALUE_NUMBER, …

JSON Processing 1.0

Streaming Parser

```
{
    “firstName”: “John”,  “lastName”: “Smith”,  “age”: 25,
    “phoneNumber”: [
          {  “type”: “home”,  “number”:  “212 555-1234” },
          {  “type”: “fax”,  “number”:  “646 555-4567” }
     ]
}
```

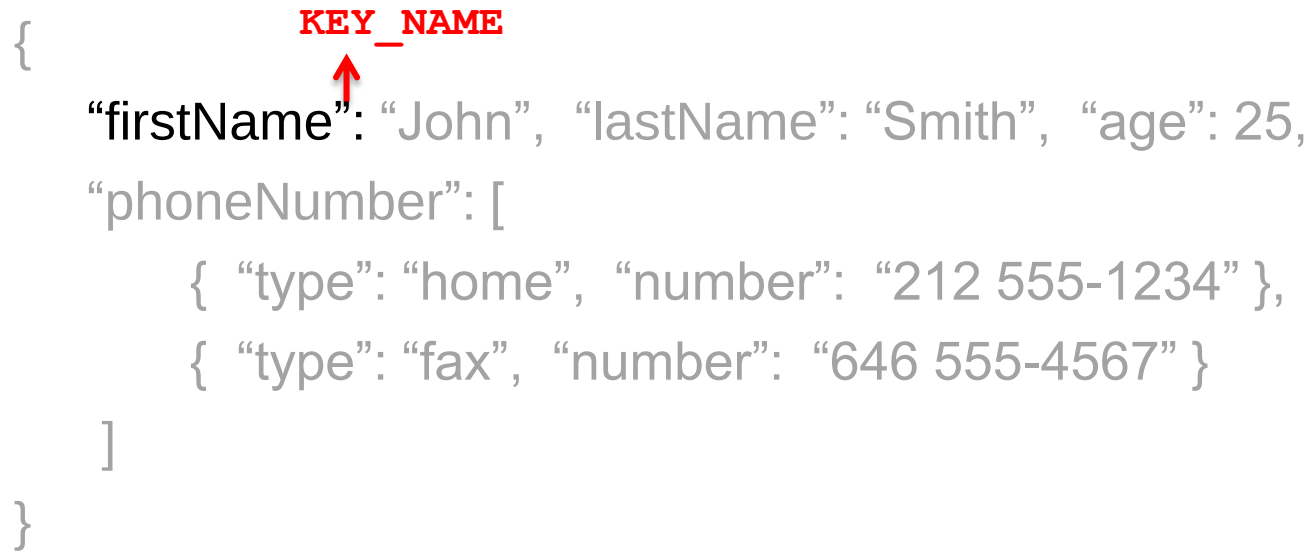
JSON Processing 1.0

Streaming Parser

```
{  START_OBJECT
   “firstName”: “John”,  “lastName”: “Smith”,  “age”: 25,
     “phoneNumber”: [
           {  “type”: “home”,  “number”:  “212 555-1234” },
           {  “type”: “fax”,  “number”:  “646 555-4567” }
      ]
}
```

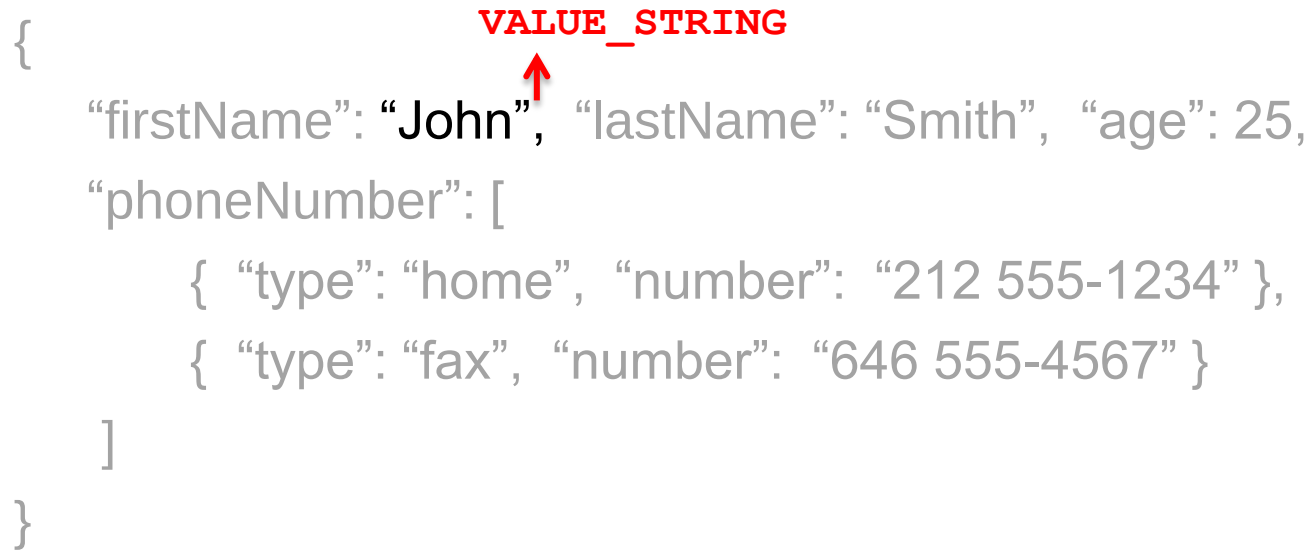
JSON Processing 1.0

Streaming Parser



JSON Processing 1.0

Streaming Parser



JSON Processing 1.0

Streaming Parser

```
{
    “firstName”: “John”,  “lastName”: “Smith”,  “age”: 25,
    “phoneNumber”: [
          {  “type”: “home”,  “number”:  “212 555-1234” },
          {  “type”: “fax”,  “number”:  “646 555-4567” }
     ]
}
```

VALUE_NUMBER

JSON Processing 1.0

Streaming Parser

```
{
    “firstName”: “John”,  “lastName”: “Smith”,  “age”: 25,
    “phoneNumber”: [ ↑START_ARRAY
          {  “type”: “home”,  “number”:  “212 555-1234” },
          {  “type”: “fax”,  “number”:  “646 555-4567” }
     ]
}
```

JSON Processing 1.0

Streaming Parser

```
{
    “firstName”: “John”,  “lastName”: “Smith”,  “age”: 25,
    “phoneNumber”: [
        {  “type”: “home”,  “number”:  “212 555-1234” },
        {  “type”: “fax”,  “number”:  “646 555-4567” }
    ]
}
```

END_ARRAY

JSON Processing 1.0

Using Streaming API to generate JSON

```
JsonGenerator gen = Json.createGenerator…
    .writeStartObject()
      .write("firstName", "John")
      .write("lastName", "Smith")
      .write("age", 25)
      .writeStartArray(“phones”)
         .writeStartObject()
           .write(“type", “home")
           .write(“number”, “222 555-1234”))
         .writeEnd()
         .writeStartObject()   …   .writeEnd()
      .writeEnd()
    .writeEnd();
```

```
{ "firstName": "John",  "lastName": "Smith", "age": 25,
  “phones" : [
     {  “type”:  “home”,  “number”: “ 222 555-1234” },
     {  “type”:  “fax”,  “number”: “ 646 555-4567” }
  ]
}
```

JSON Processing 1.0

Object Model API

- JsonObject/JsonArray – JSON object and array structures
  - JsonString and JsonNumber for string and number values
- JSON builders – build JsonObject and JsonArray
- JsonReader – reads JsonObject and JsonArray
- JsonWriter – writes JsonObject and JsonArray

JSON Processing 1.0

JSON Object-level API

```
JsonObject value = Json.createObjectBuilder()
    .add("firstName", "John")
    .add("lastName", "Smith")
    .add("age", 25)
    .add(“phones", Json.createArrayBuilder()
      .add(Json.createObjectBuilder()
           .add(“type", “home")
           .add(“number”, “222 555-1234”))
      .add(“Json.createObjectBuilder()
           .add(“type", “fax")
           .add(“number”, “646 555-4567”)))
   .build();
```

```
{ "firstName": "John",  "lastName": "Smith",  "age": 25,
   “phones" : [
      {  “type”:  “home”,  “number”: “ 222 555-1234” },
      {  “type”:  “fax”,  “number”: “ 646 555-4567” }
   ]
}
```

Java API for WebSocket 1.0

- Bidirectional full-duplex messaging
  - Over a single TCP connection
- Annotation-based or interface-based programming model
- Server and Client WebSocket Endpoints
  - Annotated: @ServerEndpoint, @ClientEndpoint
  - Programmatic: Endpoint
- Integrated with Java EE web container
- Highly configurable
- Simple packaging and deployment as wars or jars

Java API for WebSocket 1.0

Main API classes

- Endpoint
  - intercepts websocket lifecycle events
- MessageHandler
  - handles incoming messages for endpoint
- Session
  - represents the active conversation
- RemoteEndpoint
  - represents the other end of the conversation

WebSocket Endpoints

Programmatic API

```
public class MyClient extends Endpoint {
    public void onOpen(Session session, EndpointConfig ec) {
        session.addMessageHandler(new MessageHandler.Whole<String>() {
            public void onMessage(String text) {
                System.out.println("Message came from the server : " + message”);
            }
         }
        session.getBasicRemote().sendText("Hello!");
    }

    public void onClose(Session session, CloseReason closeReason) {
        super.onClose(session, closeReason);
    }
}
```

WebSocket Endpoints as POJOs

Annotated client endpoint

```
@ClientEndpoint
public class MyClient {
    @OnOpen public void onOpen(Session session) {
        session.getBasicRemote().sendText(“Hello”);
    }
    @OnMessage public void onMessage(String text, Session session)  {
        System.out.println("Message came from the server : " + message);
    }
}
```

WebSocket Endpoints as POJOs

Annotated server endpoint

```
@ServerEndpoint("/chat")   public class ChatServer {

    static Set<Session> peers = Collections.synchronizedSet(…);

    @OnOpen public void onOpen(Session peer) {
        peers.add(peer);
    }
    @OnMessage public void  onMessage (String message, Session client) {
        for (Session peer : peers) {
            peer.getBasicRemote().sendObject(message);
        }
     }
    @OnClose public void onClose(Session peer) {
        peers.remove(peer);
    }
}
```

Java API for RESTful Web Services (JAX-RS) 2.0

- Client API
- Filters and Interceptors
- Asynchronous Processing
- Hypermedia
- Validation

JAX-RS 1.1

Previous Client API

```
URL url = new URL("http://. . ./atm/balance");
HttpURLConnection conn = (HttpURLConnection) url.openConnection();
conn.setDoInput(true);
conn.setDoOutput(false);
conn.setRequestMethod("GET");
BufferedReader br = new BufferedReader(new InputStreamReader(conn.getInputStream()));
String line;
while ((line = br.readLine()) != null) {
 //. . .
}
```

JAX-RS 2.0

JAX-RS 2.0 Client API

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

String name= client.target("http://.../orders/{orderId}/customer")
      .resolveTemplate(“orderId”, “10”)
      .request()
      .get(String.class);
```

JAX-RS 2.0

JAX-RS 2.0 Client API

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

WebTarget  target = client.target("http://.../orders/{orderId}/customer")
        .register(LoggingFilter.class);

String name =  target.resolveTemplate(“orderId”, “10”)
     .request()
     .get(String.class);
```

JAX-RS 2.0

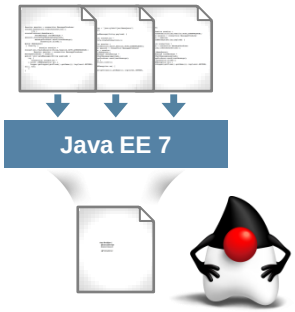
Bean Validation

```
@Path("/")
class MyResourceClass {

    @POST
    @Consumes(MediaType.APPLICATION_FORM_URLENCODED)
    public void registerUser(
        @NotNull @FormParam("firstName") String firstName,
        @NotNull @FormParam("lastName") String lastName,
        @Email @FormParam("email") String email) {
        ... }
    …
}
```

Alignment and Simplification of Managed Beans

Cohesive, integrated model



- CDI is core component model
- CDI enabled by default
- Expanded use of CDI Interceptors
  - Transactional interceptors
  - Method-level validation interceptors
- New CDI scopes: @TransactionScoped, @FlowScoped

Managed Bean Alignment

Expanded use of CDI

- CDI injection and CDI interceptors apply to all Java EE components and related managed classes when CDI is enabled
- CDI is enabled by default in implicit bean archives
  - Use of CDI bean-defining annotations (@SessionScoped, @Dependent,…) and session beans result in implicit bean archives
    - Library jars, EJB jars, WEB-INF/classes
  - beans.xml not required

Transactional Interceptors

Annotations and semantics defined in JTA 1.2

```
@Inherited
@InterceptorBinding
@Target({TYPE, METHOD}) @Retention(RUNTIME)
public @interface Transactional {
    TxType value() default TxType.REQUIRED;
    Class[] rollbackOn() default {};
    Class[] dontRollbackOn() default {};
}

@Transactional(rollbackOn={SQLException.class},
                        dontRollbackOn={SQLWarning.class})
 public class ShoppingCart {…}
```

Bean Validation 1.1
Method-level Validation

Via CDI Interceptors

```
@Stateless
public class OrderService {
  …
   @ValidOrder
   public Order placeOrder(
      @NotNull String productName,
      @Max(10) int quantity,
      @NotNull String customerName,
      @Address String customerAddress) {
     …
  }
}
```

Interceptor Ordering

Well-defined priority ordering

- Interceptor.Priority.PLATFORM_BEFORE = 0
  - Platform-defined interceptors to be executed at beginning of interceptor chain
  - Transactional interceptors: Interceptor.Priority.PLATFORM_BEFORE+200
- Interceptor.Priority.LIBRARY_BEFORE = 1000
  - Intended for use by extension libraries
- Interceptor.Priority.APPLICATION = 2000
  - Intended for application-defined interceptors
- Interceptor.Priority.LIBRARY_AFTER = 3000
- Interceptor.Priority.PLATFORM_AFTER = 4000
  - Bean Validation defined interceptors: Interceptor.Priority.PLATFORM_AFTER+800

Resource Definition Metadata

- Specifies resources needed by application
  - Enhances configurability in Java EE 7 apps
  - Facilitates provisioning in cloud environments
  - Java EE 6 introduced DataSourceDefinition

```
@DataSourceDefinition (
    name="java:app/jdbc/myDB",
    className="oracle.jdbc.pool.OracleDataSource",
    isolationLevel=TRANSACTION_REPEATABLE_READ,
    initialPoolSize=5)
@Stateless public class MySessionBean {
     @Resource(lookup="java:app/jdbc/myDB")  DataSource my DB;
     …
 }
```

Resource Definition Metadata

- Java EE 7 adds:
  - JMSConnectionFactoryDefinition
  - JMSDestinationDefinition
  - MailSessionDefinition
  - ConnectionFactoryDefinition
  - AdministeredObjectDefinition

Default Resources

Preconfigured resources for use by application

- JDBC/JPA: java:comp/DefaultDataSource
- JMS: java:comp/DefaultJMSConnectionFactory
- Concurrency Utilities:
  - java: comp/DefaultManagedExecutorService
  - java: comp/DefaultManagedScheduledExecutorService
  - java: comp/DefaultManagedThreadFactory
  - java: comp/DefaultManagedContextService

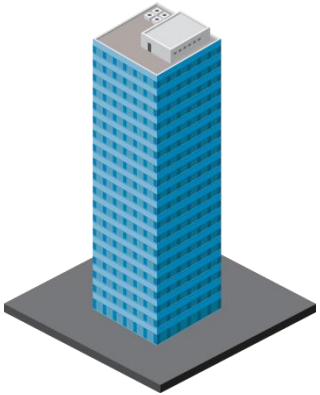
Simplification through Pruning

- Process defined in Java SE 6
  - Platform version N defines feature as “Proposed Optional”
  - Platform version N+1 determines whether to make feature Optional
- Optional APIs as of Java EE 7
  - EJB Entity Beans (CMP, BMP, EJB QL)
  - JAX-RPC
  - JAXR
  - Deployment (JSR 88)

Java Message Service 2.0

New JMS Simplified API targeted at ease of development

- Less code, less boilerplate
- Fewer objects to manage
- Increased developer productivity
- “Classic API” has also been improved



JMS 2.0

Simplifications include….

- New JMSContext interface
- Use of CDI injection; new TransactionScope
- AutoCloseable JMSContext, Connection, Session, …
- Use of runtime exceptions
- Method chaining on JMSProducer
- Simplified message sending

JMS 1.1

Sending a message in the JMS 1.1 “classic” API

```
@Resource(lookup = “java:global/jms/myConnectionFactory”)
ConnectionFactory connectionFactory;

@Resource(lookup = “java:global/jms/myQueue”)
Queue queue;

public void sendMessage(String text) {
  try {
        Connection connection = connectionFactory.createConnection();
        Session session = connection.createSession(false, Session.AUTO_ACKNOWLEDGE);
        MessageProducer messageProducer = session.createProducer(queue);
        TextMessage textMessage = session.createTextMessage(text);
        messageProducer.send(textMessage);
   } finally {
        connection.close();
   }  catch (JMSException ex)  {…}
}
     ..
```


JMS 2.0

Sending a message using Simplified API and JMSContext

```
@Resource(lookup = “java:global/jms/myConnectionFactory”)
ConnectionFactory connectionFactory;

@Resource(lookup = “java:global/jms/myQueue”)
Queue queue;

public void sendMessage(String text) {
  try (JMSContext context =  connectionFactory.createContext();) {
    context.createProducer().send(queue, text);
   } catch (JMSRuntimeException ex) {
     …
   }
}
```

JMS 2.0

Even simpler….

```
@Inject
@JMSConnectionFactory(““java:global/jms/myConnectionFactory”)
JMSContext context;

@Resource(lookup = “java:global/jms/myQueue”)
Queue queue;

public void sendMessage(String text) {
    context.createProducer().send(queue, text);
}
```

JMS 2.0

Even simpler still….

```
@Inject
JMSContext context;

@Resource(lookup = “java:global/jms/myQueue”)
Queue queue;

public void sendMessage(String text) {
    context.createProducer().send(queue, text);
}
```

Concurrency Utilities for Java EE 1.0

Provides asynchronous capabilities to Java EE components

- Extension of Java SE Concurrency Utilities API
- Provides managed objects for submitting tasks and obtaining managed threads
  - ManagedExecutorService
  - ManagedScheduledExecutorService
  - ManagedThreadFactory
  - ContextService

Concurrency Utilities for Java EE 1.0

```
public class AccountTask implements Callable {
  ...
  public AccountInfo call() {
  // task logic
  }
  ...
}

//in calling component:
   @Resource
   ManagedExecutorService mes;
   ...
   Future<AccountInfo> acctFuture = mes.submit(new AccountTask(...));
   AccountInfo accountInfo = acctFuture.get(); // Wait for the results.
   …
   // Process the results
   ...
```

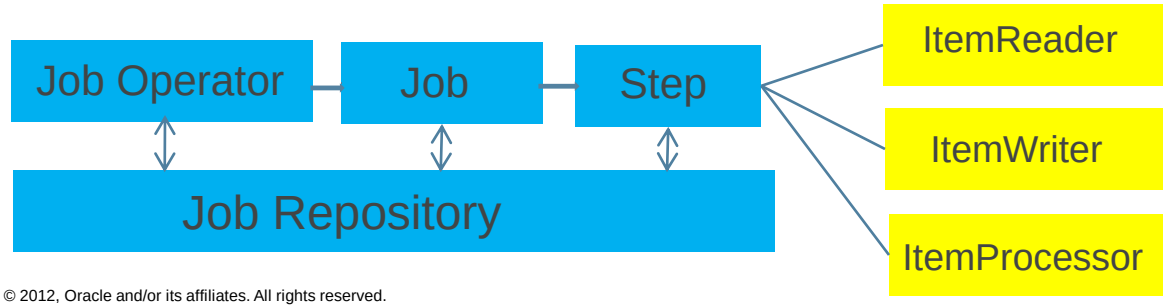
Batch Applications for the Java Platform 1.0

- Designed for non-interactive, bulk-oriented and long-running tasks
- Sequential, parallel, and/or decision-based batch execution
- Processing styles
  - Item-oriented (“chunked”)
  - Task-oriented (“batchlet”)

Batch 1.0

Key concepts

- Job: entire batch process
  - Defined through XML Job Specification Language
- Step: independent, sequential phase of a job
- JobOperator: interface for managing job processing
- JobRepository: information about past and present jobs



Batch 1.0

Job steps

- Chunked step: Item-oriented processing
  - ItemReader/ItemProcessor/ItemWriter pattern
  - Configurable checkpointing and transactions
- Batchlet: Task-oriented processing
  - Roll-your-own batch pattern
  - Runs to completion and exits
- Job can include both types of steps

Batch 1.0

Job specification language

```
<job id="myJob" xmlns="http://xmlns.jcp.org/xml/ns/javaee" version="1.0">
   <step id="step1" next="step2">
      <chunk item-count="3">
         <reader ref="myItemReader"></reader>
         <processor ref="myItemProcessor"></processor>
         <writer ref="myItemWriter"></writer>
      </chunk>
   </step>
   <step id="step2"  next=“step3”>
      <batchlet ref="myBatchlet"/>
   </step>
 <step id="step3" >
      <chunk item-count="3">
         <reader ref="myOtherItemReader"></reader>
         <processor ref="myOtherItemProcessor"></processor>
         <writer ref="myOtherItemWriter"></writer>
      </chunk>
   </step>
</job>
```

Java Persistence API 2.1

Schema generation

- Generation of database tables, indexes, constraints, etc.
- Designed for flexibility
  - Scenarios: (iterative) prototyping; production; provisioning environments
  - Generate from object/relational metadata (annotations and/or XML)
  - Generate from bundled SQL DDL scripts; also SQL load scripts
  - Generate directly into database
  - Generate into SQL DDL scripts
- Process controlled by metadata or runtime properties

JPA 2.1

Schema generation into scripts

```
<?xml version="1.0" encoding="UTF-8"?>
<persistence version="2.1" xmlns="http://xmlns.jcp.org/xml/ns/persistence"
   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
   xsi:schemaLocation="http://xmlns.jcp.org/xml/ns/persistence
   http://xmlns.jcp.org/xml/ns/persistence/persistence_2_1.xsd">
   <persistence-unit name=“samplePU" transaction-type="JTA">
      <jta-data-source>jdbc/mypu</jta-data-source>
      <properties>
         <property name="javax.persistence.schema-generation.database.action" value="none" />
         <property name="javax.persistence.schema-generation.scripts.action" value=“drop-and-create"/>
         <property name="javax.persistence.schema-generation.scripts.create-target" value="file:///c:/temp/create.sql"/>
         <property name="javax.persistence.schema-generation.scripts.drop-target" value="file:///c:/temp/drop.sql"/>
      </properties>
  </persistence-unit>
</persistence>
```

JPA 2.1

Schema generation from scripts

```
<?xml version="1.0" encoding="UTF-8"?>
<persistence version="2.1" xmlns="http://xmlns.jcp.org/xml/ns/persistence"
   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
   xsi:schemaLocation="http://xmlns.jcp.org/xml/ns/persistence
   http://xmlns.jcp.org/xml/ns/persistence/persistence_2_1.xsd">
   <persistence-unit name="samplePU" transaction-type="JTA">
      <jta-data-source>jdbc/mypu</jta-data-source>
      <properties>
         <property name="javax.persistence.schema-generation.database.action" value="drop-and-create"/>
         <property name="javax.persistence.schema-generation.create-source" value="script"/>
         <property name="javax.persistence.schema-generation.drop-source" value="script"/>
         <property name="javax.persistence.schema-generation.create-script-source" value="META-INF/create.sql"/>
         <property name="javax.persistence.schema-generation.drop-script-source" value="META-INF/drop.sql"/>
         <property name="javax.persistence.sql-load-script-source" value="META-INF/load.sql"/>
      </properties>
   </persistence-unit>
</persistence>
```

Java EE 7 Summary

- More annotated POJOs
- Less boilerplate code
- Cohesive integrated platform

- WebSockets
- JSON
- Servlet 3.1 NIO
- REST

- Batch
- Concurrency
- Simplified JMS

Transparency in JSR processes

All Java EE JSRs run with high level of transparency

- java.net used for all Oracle-led JSRs
  - http://java.net/projects/javaee-spec/pages/Home
- Publicly viewable Expert Group mailing archives
- Users observer lists get copies of all Expert Group emails
- Public download areas, JIRAs
- Wikis, source repositories, etc. at the group discretion
- Commitment to JCP 2.8/2.9 processes

Meet the Java EE Specleads

Tomorrow afternoon

BOF 2795 “Meet the Java EE Specification Leads”

Tuesday, 4:30-5:30

Parc 55 – Cyril Magnin I

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