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JAX-RS: The Java™ API for RESTful Web Services

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Learn how to build RESTful Web services using JAX-RS.

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GOAL

Agenda

- **REST Primer**
 - REST in Five Steps
 - Common Patterns and Best Practices
 - Key Benefits
- **RESTful Design and API Elements**
- **Building a Simple Service**
- **Deployment Options**
- **Status**
- **Q & A**

Very Short Primer: Buy This Book



Short Primer – REST in Five Steps*

- Give everything an ID
- Link things together
- Use standard methods
- Multiple representations
- Stateless communications

* Inspired by Stefan Tilkov:

<http://www.innoq.com/blog/st/presentations/2008/2008-03-13-REST-Intro-QCon-London.pdf>

Give Everything an ID

➤ ID is a URI

<http://example.com/widgets/foo>

<http://example.com/customers/bar>

<http://example.com/customers/bar/orders/2>

<http://example.com/orders/101230/customer>

Link Things Together

```
<prop self="http://example.com/orders/101230">  
  <customer ref="http://example.com/customers/bar">  
    <product ref="http://example.com/products/21034"/>  
    <amount value="1"/>  
</order>
```

Use Standard Methods

Method	Purpose
GET	Read, possibly cached
POST	Update or create without a known ID
PUT	Update or create with a known ID
DELETE	Remove

Multiple Representations

- Offer data in a variety of formats
 - XML
 - JSON
 - (X)HTML
- Maximize reach
- Support content negotiation
 - Accept header
`GET /foo`
`Accept: application/json`
 - URI-based
`GET /foo.json`

Stateless Communications

- Long lived identifiers
- Avoid sessions
- Everything required to process a request contained in the request

Common Patterns: Container, Item

Server in control of URI path space

- List container contents: **GET** `/container`
- Add item to container: **POST** `/container`
 - with item in request
 - URI of item returned in HTTP response header
 - e.g. **Location**: `http://host/container/item`
- Read item: **GET** `/container/item`
- Update item: **PUT** `/container/item`
 - with updated item in request
- Remove item: **DELETE** `/container/item`
- Good example: Atom Publishing Protocol

Common Patterns: Map, Key, Value

Client in control of URI path space

- List key-value pairs: **GET** /map
- Put new value to map: **PUT** /map/{key}
 - with entry in request
 - e.g. **PUT** /map/dir/contents.xml
- Read value: **GET** /map/{key}
- Update value: **PUT** /map/{key}
 - with updated value in request
- Remove value: **DELETE** /map/{key}
- Good example: Amazon S3

Key Benefits

➤ Server side

- Horizontal scaling
- Straightforward failover
- Cacheable
- Reduced coupling
- Works well with existing Web infrastructure

➤ Client side

- Bookmarkable
- Easy to experiment in browser
- Broad programming language support
- Choice of data formats

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Give Everything an ID

- “Thing” == resource class
 - POJO
 - No required interfaces
- ID provided by `@Path` annotation
 - Relative to deployment context
 - Embedded parameters for non-fixed parts of the URI
 - Annotate class or “sub-resource locator” method

```
@Path("orders/{order_id}")
public class OrderResource {

    @Path("customer")
    CustomerResource getCustomer(...) {...}
}
```

Link Things Together

- **UriInfo** provides information about deployment context, the request URI and the route to the resource
- **UriBuilder** provides facilities to easily construct URIs for resources

```
@Context UriInfo i;
```

```
OrderResource r = ...
```

```
UriBuilder b = i.getBaseUriBuilder();
```

```
URI u = b.path(OrderResource.class).build(r.id);
```

```
List<URI> ancestors = i.getAncestorResourceURIs();
```

```
URI parent = ancestors.get(ancestors.size()-1);
```


Use Standard Methods

- Annotate resource class methods with standard method
 - @GET, @PUT, @POST, @DELETE, @HEAD
 - @HttpMethod meta-annotation allows extensions, e.g. WebDAV
- Flexible method signatures, annotations on parameters specify mapping from request data
- Return value mapped to response

```
@Path("orders/{order_id}")
public class OrderResource {
    @GET
    Order getOrder(@PathParam("order_id") String id) {
        ...
    }
}
```

Multiple Representations

Static and dynamic content negotiation

- Annotate methods or classes with static capabilities
 - `@ProduceMime`, `@ConsumeMime`
- Use `Variant`, `VariantListBuilder` and `Request.selectVariant` for dynamic capabilities

```
@GET
@ProduceMime({"application/xml", "application/json"})
Order getOrder(@PathParam("order_id") String id) {
    ...
}
```

```
@GET
@ProduceMime("text/plain")
String getOrder(@PathParam("order_id") String id) {
    ...
}
```

Building a Simple Service

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DEMO

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- REST Primer
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- **Deployment Options**
 - Java SE
 - Java Servlet API
 - Java EE
 - Other
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Java SE

- **RuntimeDelegate** used to create instances of a desired endpoint class
- Application supplies configuration information
 - List of resource classes and providers as subclass of **ApplicationConfig**
- Implementations can support any Java type
 - Jersey supports Grizzly (see below), LW HTTP server and JAX-WS Provider

```
ApplicationConfig config = ...
RuntimeDelegate rd = RuntimeDelegate.getInstance();
Adapter a = rd.createEndpoint(config, Adapter.class);
SelectorThread st = GrizzlyServerFactory.create(
    "http://127.0.0.1:8084/", a);
```

Servlet

- JAX-RS application packaged in **WAR** like a servlet
- For JAX-RS aware containers
 - `web.xml` can point to **ApplicationConfig** subclass
- For non-JAX-RS aware containers
 - `web.xml` points to implementation-specific **Servlet**; and
 - an `init-param` identifies the **ApplicationConfig** subclass
- Resource classes and providers can access **Servlet** request, context, config and response via injection

Java EE 6 Plans

- Applications deployed in an Java EE 6 Web container will have access to additional resources and capabilities:
 - Resources (`@Resource`, `@Resources`)
 - Web Services (`@WebServiceRef`, `@WebServiceRefs`)
 - EJB (`@EJB`, `@EJBs`)
 - Persistence (`@PersistenceContext`, `@PersistenceUnit`, ...)
 - Lifecycle management (`@PostConstruct`, `@PreDestroy`)
 - Security (`@RolesAllowed`, `@RunAs`, `@PermitAll`, ...)
- Hoping to be able to make use of Web Beans (JSR 299) for much of this

Other

- Easy to implement for other containers
- Implementation work underway for:
 - Restlet
 - JBoss RESTEasy
 - Apache CXF
 - Jersey

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Status

- Early Draft Review completed November 2007
- Currently in Public Review
- July: Proposed Final Draft
- September: Final Release

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For More Information

- BOF-5613 - Jersey: RESTful Web Services Made Easy
- Official JSR Page
 - <http://jcp.org/en/jsr/detail?id=311>
- JSR Project
 - <http://jsr311.dev.java.net/>
- Reference Implementation
 - <http://jersey.dev.java.net/>
- Marc's Blog
 - <http://weblogs.java.net/blog/mhadley/>
- Paul's Blog
 - <http://blogs.sun.com/sandoz/>
- Jakub's Blog
 - <http://blogs.sun.com/japod/>

THANK YOU



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