



Webanwendungen mit MVC API 1.0 und Eclipse Krazo

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Frontends für Jakarta EE (bisher)



Jakarta Server Pages (JSP)

- Seit ca. 1999 Teil von Java EE
- Kompilieren direkt in Java Code (Servlets)
- Template-Engine nicht wählbar
- MVC Pattern nur mit Frameworks (Struts) umsetzbar

Jakarta Server Faces (JSF)

- Seit 2003 Teil von Java EE
- Basiert auf zentralem FacesServlet
- Template-Engine nicht wählbar
- Komponentenbasiertes MVC
- Komplexer Request-Cycle

Irgendetwas fehlt...
... und zwar ein actionbasiertes Frontend!

Frontends für Jakarta EE (jetzt)



Jakarta Server Pages (JSP)



Jakarta Server Faces (JSF)

MVC API

Ein bisschen Geschichte...

2014: Beginn der Entwicklung an MVC 1.0 bei Oracle

2017: Oracle gibt Spec Lead an Community (Ivar Grimstad) ab

Ende 2018: Eintritt in „Final Release“ Phase des JCP

Anfang 2019: Eclipse Krazo ist TCK kompatibel

Dezember 2019: Release des ersten Release Candidate von Spec und RI

Januar 2020: Release der Version 1.0.0 von Spec und RI

Eigenschaften der API

Abstrakt

- Entwicklung actionbasierter, serverseitig gerenderter Frontends
 - Vorteil: Nutzung der HTTP Semantik (z.B. Verben) möglich
- Verschiedene SPIs zur Anbindung zusätzlicher View-Engines und anderer Komponenten
 - Implementierungen müssen Adapter für JSP und JSF bereitstellen

Technisch

- Basiert auf JAX-RS 2.1 (-> kompatibel ab Jakarta EE 8)
- Unterstützt CDI und Bean Validation

Was schauen wir uns an?

Projektinitialisierung /
-struktur

Views anzeigen,
befüllen und verlinken

Forms und Security

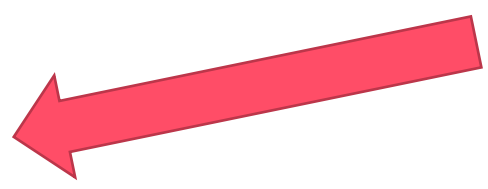
HTTP Verben Support
(Krazo only)

Benötigte Abhängigkeiten

```
plugins {  
    id 'java'  
    id 'war'  
}  
  
repositories {  
    jcenter()  
    mavenCentral()  
}
```

```
dependencies {  
    //...  
  
    implementation 'javax.mvc:javax.mvc-api:1.0.0'  
    implementation 'org.eclipse.krazo:krazo-resteasy:1.0.0'  
    // implementation 'org.eclipse.krazo.ext:krazo-thymeleaf:1.0.0'  
  
    providedCompile 'jakarta.platform:jakarta.jakartaee-web-api:8.0.0'  
    //...  
}
```

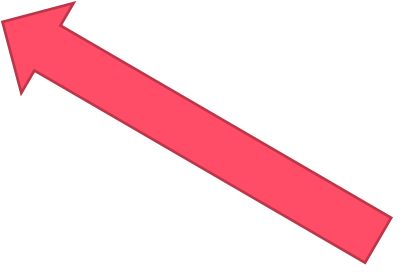
MVC API



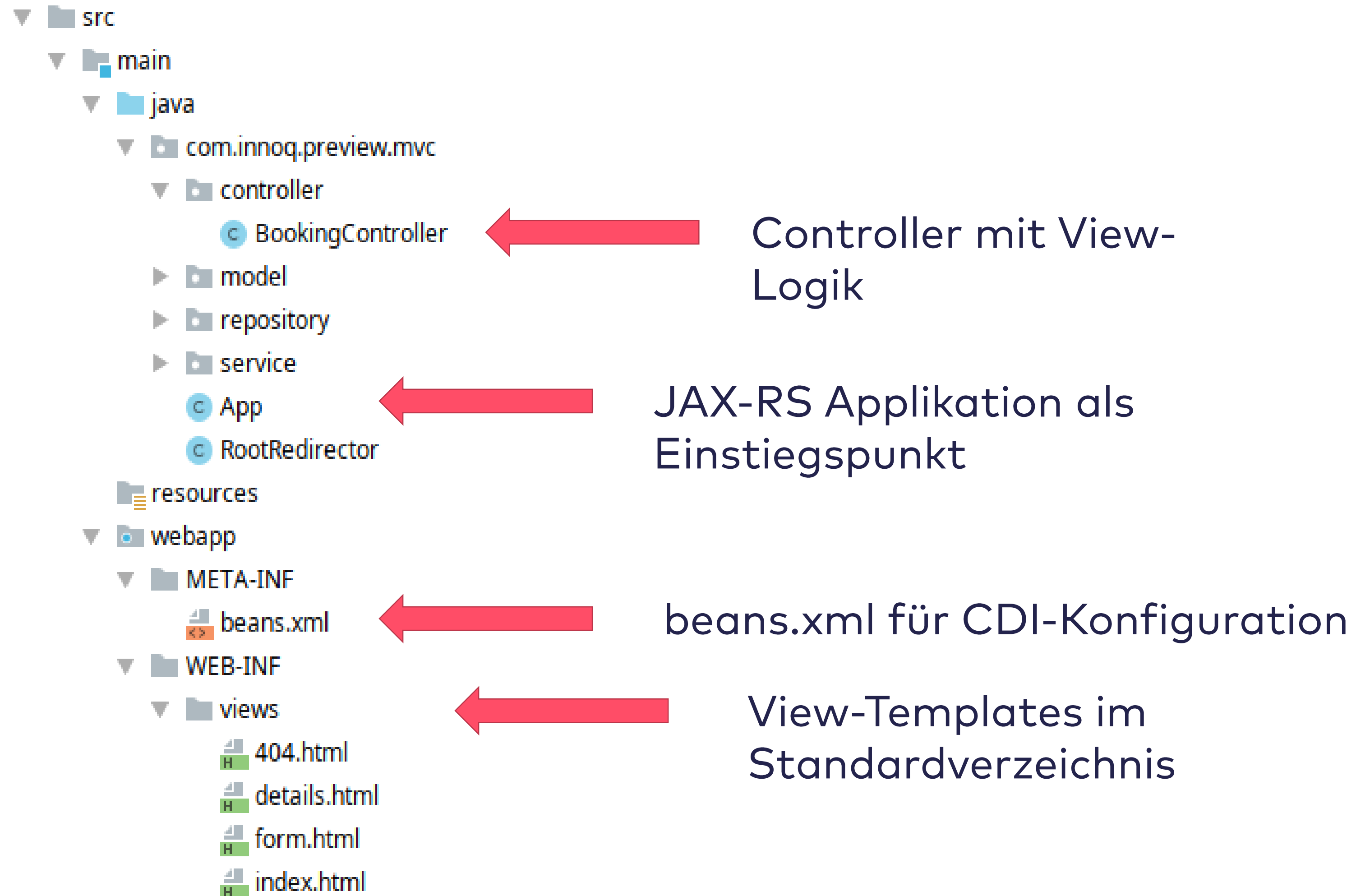
RESTEasy Support von Eclipse
Krazo (für Wildfly)



Thymeleaf-Extension als
optionale View-Engine



Projektstruktur



JAX-RS Applikation

```
import javax.ws.rs.ApplicationPath;  
import javax.ws.rs.core.Application;  
  
@ApplicationPath("/mvc")  
public class App extends Application {  
  
}
```



Context Root sollte nicht verwendet werden.

"The reason for this is that MVC implementations often forward requests to the Servlet container, and the use of the aforementioned values may result in the unwanted processing of the forwarded request by the JAX-RS servlet once again"

- MVC Specification

Hello World!

GET http://<host>/mvc/hello

```
import javax.ws.rs.GET;
import javax.ws.rs.Path;

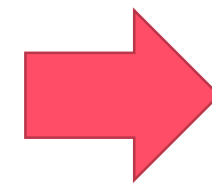
@Path("hello")

public class
HelloWorldController {

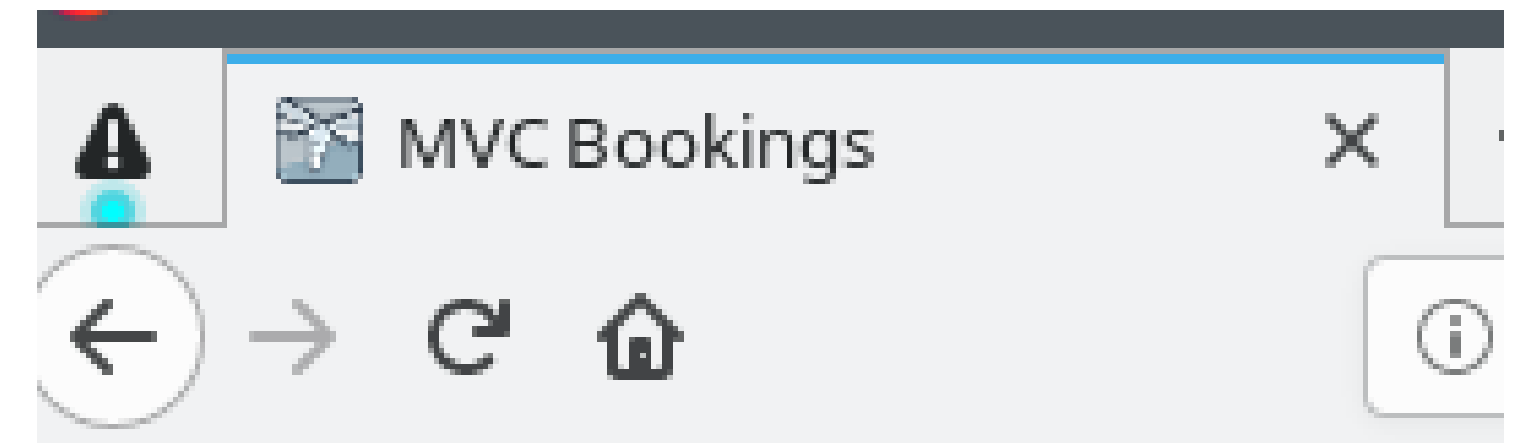
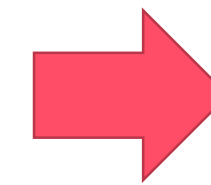
    @GET
    public String sayHello() {

    }

}
```



```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <title>Hello World</title>
</head>
<body>
<h1>Hello World!</h1>
</body>
</html>
```



Hello World!

Die Booking-Applikation

Buchungsübersicht

GET http://<host>/mvc/bookings

MVC Bookings

Booking overview

New

Booking number	Name	Status		
cbf6880d-f9dc-4016-9411-b41faf7ab9fd	Augsburg -> München	Active	Details	Cancel
27360a91-915a-48d0-8162-8cebb14f4789	Berlin -> München	Cancelled	Details	Cancel
59e089a7-344c-4089-89c9-53ba0426e29f	München -> Augsburg	Active	Details	Cancel
71010fc9-546c-4652-8e17-b010bf61da0c	München -> Berlin	Cancelled	Details	Cancel

Buchungsübersicht

GET http://<host>/mvc/bookings

```
@Path("/bookings")
@Controller
public class BookingController {

    // ...

    @Inject
    private Models models; ← Model für View

    @GET
    public String index() {
        final var bookings = bookingService.getAllBookings();

        models.put("bookings", bookings); ← „bookings“ für View bereitstellen

        return "index.jsp";
    }

    // ...
}
```

Verwendung des Models

GET http://<host>/mvc/bookings

```
@Path("/bookings")
@Controller
public class BookingController {
```

```
// ...
```

```
@Inject
private Models models;
```

```
@GET
public String showIndex() {
    // ...
    models.put("bookings", bookings);

    return "index.jsp";
}
```

```
// ...
```

```
}
```

```
<c:forEach var="booking" items="${bookings}">
    <tr>
        <td>${booking.bookingNumber}</td>
        <td>${booking.name}</td>
    </tr>
</c:forEach>
```


Buchungsübersicht

GET http://<host>/mvc/bookings

```
@Path("/bookings")
@Controller
public class BookingController {

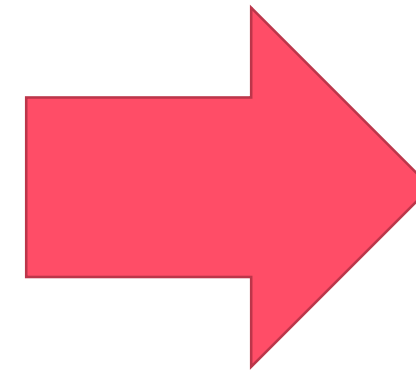
    // ...

    @Inject
    private Models models;

    @GET
    public String showIndex() {
        final var bookings =
            bookingService.getAllBookings();
        models.put("bookings", bookings);

        return "index.jsp";
    }

    // ...
}
```



Booking number	Name	Status
116f1dad-577f-4ca0-abe0-432bd0730717	Augsburg -> München	Active
4b0e1c6a-b7b6-45ee-b5b0-f5b7423086a3	Berlin -> München	Cancelled
cae9e31f-d4d0-42ca-ad48-cc36a53e9611	München -> Augsburg	Active
0f4faa58-f5e1-4593-8014-53e5115ce12d	München -> Berlin	Cancelled

Nun kennen wir alle MVC Bestandteile!

Model

```
@Inject  
private Models models;
```

View

```
<c:forEach var="booking" items="${bookings}">  
  <tr>  
    <td>${booking.bookingNumber}</td>  
    <td>${booking.name}</td>  
    ...  
</c:forEach>
```

Controller

```
@Path("/bookings")  
@Controller  
public class BookingController {  
  
    // ...  
  
    @Inject  
    private Models models;  
  
    @GET  
    public String showIndex() {  
        // ...  
        return "index.jsp";  
    }  
  
    // ...  
}
```

Buchungsdetails

GET http://<host>/mvc/bookings/{bookingNumber}

MVC Bookings

Booking details

Booking number

727b8064-a512-4bb4-bdff-b4e20c22d96f

Name

Augsburg -> München

Status

ACTIVE

Buchungsdetails

GET http://<host>/mvc/bookings/{bookingNumber}

```
@Path("/bookings")
@Controller
public class BookingController {
```

```
// ...
```

```
@GET
```

```
@Path("/{bookingNumber}")
```

```
public Response showDetailsOfBooking(@PathParam("bookingNumber") final UUID bookingNumber) {
    final var booking = bookingService.findBookingForBookingNumber(bookingNumber);
```

```
    if (booking.isPresent()) {
        models.put("booking", booking.get());
        return Response.ok("details.jsp").build();
    } else {
```

```
        models.put("bookingNumber", bookingNumber);
        return Response.status(Response.Status.NOT_FOUND).entity("404.jsp").build();
    }
}
```

```
}
```

```
// ...
```

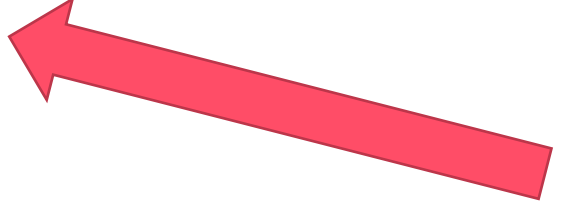
Required URL-Parameter mit Booking Number



HTTP Status 200 & Booking werden zurückgegeben



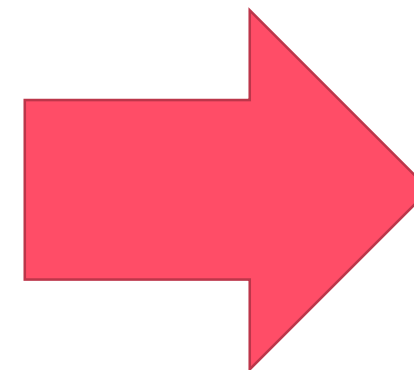
HTTP Status 404 & ungültige Booking Number



Buchungsdetails– Buchung gefunden

GET http://<host>/mvc/bookings/{bookingNumber}

```
@GET
@Path("/{bookingNumber}")
public Response showDetailsOfBooking(
@PathParam("bookingNumber") final UUID bookingNumber) {
    // ...
    if (booking.isPresent()) {
        models.put("booking", booking.get());
        return Response.ok("details.jsp").build();
    } else {
        // ...
    }
}
```



MVC Bookings

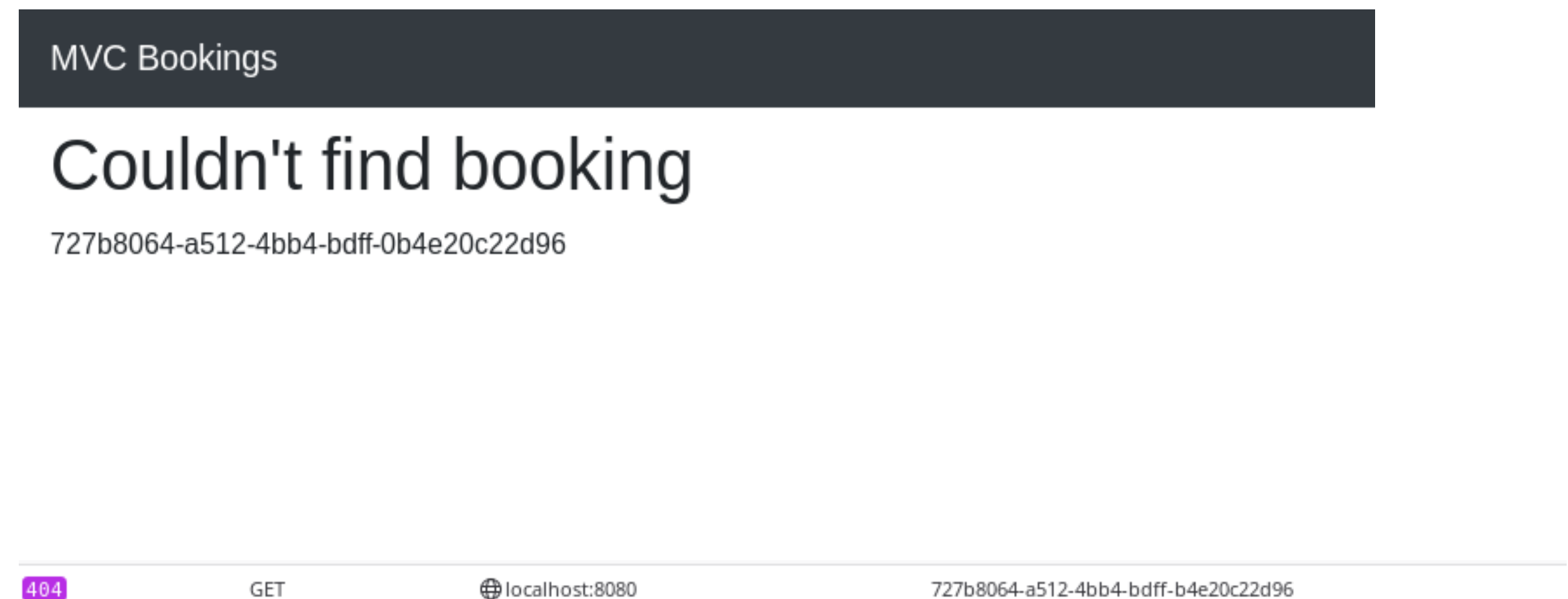
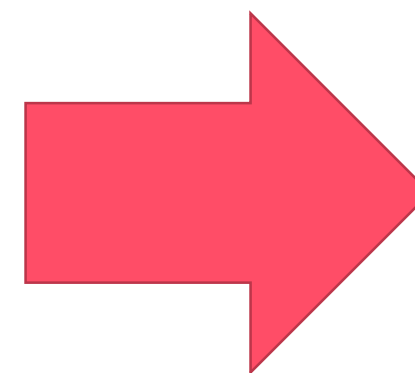
Booking details

Booking number	727b8064-a512-4bb4-bdff-b4e20c22d96f		
Name	Augsburg -> München	Status	ACTIVE

Buchungsdetails– Buchung nicht gefunden

GET http://<host>/mvc/bookings/{bookingNumber}

```
@GET
@Path("/{bookingNumber}")
public Response showDetailsOfBooking(
    @PathParam("bookingNumber") final UUID bookingNumber) {
    // ...
    if (booking.isPresent()) {
        // ...
    } else {
        models.put("bookingNumber", bookingNumber);
        return Response
            .status(Response.Status.NOT_FOUND)
            .entity("404.jsp")
            .build();
    }
}
```



Links zu Buchungsdetails

GET http://<host>/mvc/bookings

MVC Bookings

Booking overview

New

Booking number	Name	Status		
cbf6880d-f9dc-4016-9411-b41faf7ab9fd	Augsburg -> München	Active	Details	Cancel
27360a91-915a-48d0-8162-8cebb14f4789	Berlin -> München	Cancelled	Details	Cancel
59e089a7-344c-4089-89c9-53ba0426e29f	München -> Augsburg	Active	Details	Cancel
71010fc9-546c-4652-8e17-b010bf61da0c	München -> Berlin	Cancelled	Details	Cancel

Links zu Buchungsdetails

GET http://<host>/mvc/bookings

```
<a class="btn btn-link"  
href="/bookings/${booking.bookingNumber}">  
    Details  
</a>
```

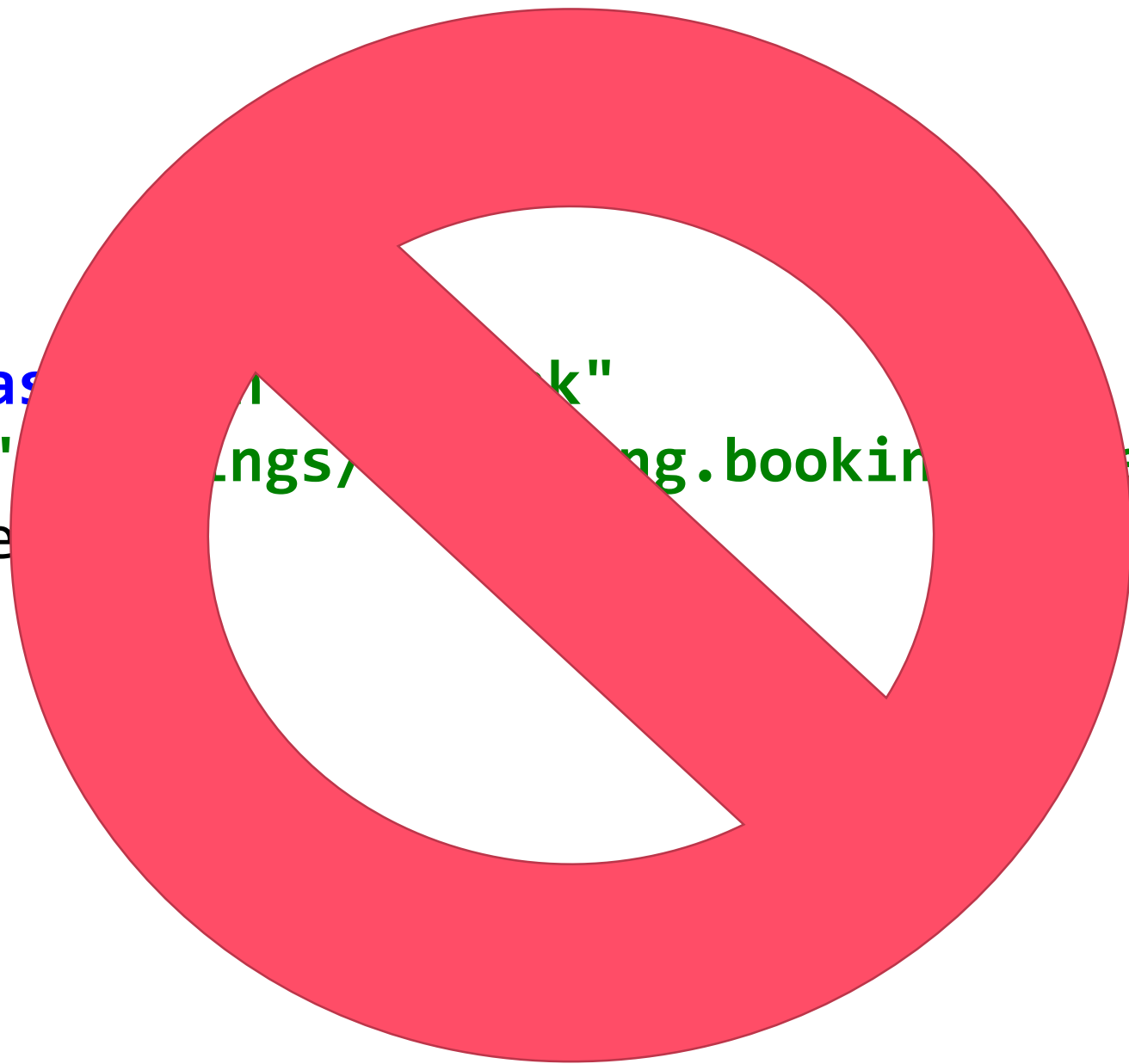


Hartcodierte, konkatenierte URL

Links zu Buchungsdetails

GET http://<host>/mvc/bookings

`<a class="link" href="http://<host>/mvc/bookings/<id>">Details</a>`



Hartcodierte, konkatenierte URL

Links zu Buchungsdetails

GET http://<host>/mvc/bookings

```
<a class="btn btn-link"
href="/bookings/${booking.bookingNumber}">
  Details
</a>
```

- Schwieriges Refactoring
- Ressourcen können nicht ohne weiteres umbenannt werden
- Fehler werden erst spät erkannt und führen zu unklaren Stacktraces

Links zu Buchungsdetails– Besser!

GET http://<host>/mvc/bookings

```
<a class="btn btn-link"
href="{mvc.uriBuilder('BookingController#showDetailsOfBooking').build(booking.bookingNumber)}">
Details
</a>
```

Controller & Methode, für welche URL generiert wird

Parameter für Controllermethode
(hier in Reihenfolge der
Parameterliste)

MvcContext#uriBuilder() zum Generieren von URLs

Links zu Buchungsdetails – Besser!

GET http://<host>/mvc/bookings

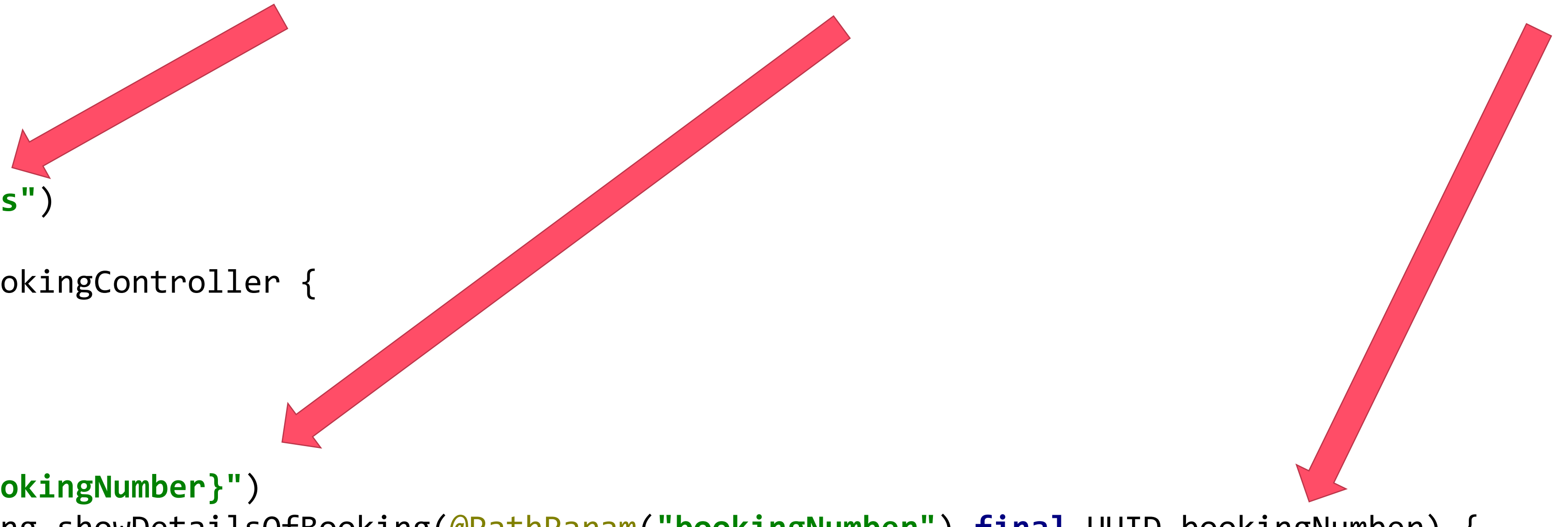
```
<a class="btn btn-link"
href="{mvc.uriBuilder('BookingController#showDetailsOfBooking').build(booking.bookingNumber)}">
Details
</a>
```

```
@Path("/bookings")
@Controller
public class BookingController {

    // ...

    @GET
    @Path("/{bookingNumber}")
    public String showDetailsOfBooking(@PathParam("bookingNumber") final UUID bookingNumber) {
        // ...
    }

    // ...
}
```



Links zu Buchungsdetails – Besser!

GET http://<host>/mvc/bookings

```
<a class="btn btn-link" th:href="${mvc  
.uriBuilder('BookingController#showDetailsOfBooking')  
.build(booking.bookingNumber) }">
```

Details

```
</a>
```

- Refactoring einfach
- Ressourcen können einfach umbenannt werden
- Nicht existierende Controller oder Methoden werden im Stacktrace genannt → einfaches Debugging

Links zu Buchungsdetails – Noch besser!

GET http://<host>/mvc/bookings

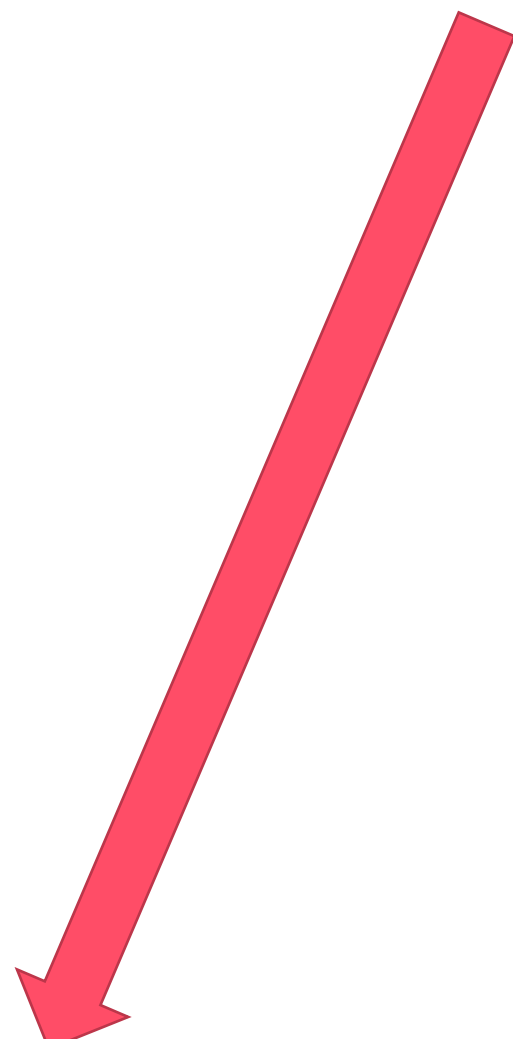
```
<a class="btn btn-link"
href="{mvc.uriBuilder('showBookingDetails').build(booking.bookingNumber)}">Details
</a>
```

```
@Path("/bookings")
@Controller
public class BookingController {

    // ...

    @GET
    @Path("/{bookingNumber}")
    @UriRef("showBookingDetails")
    public String showDetailsOfBooking(@PathParam("bookingNumber") final UUID bookingNumber) {
        // ...
    }

    // ...
}
```



Links zu Buchungsdetails – Noch besser!

GET http://<host>/mvc/bookings

```
<a class="btn btn-link" href="{mvc  
.uriBuilder('showBookingDetails')  
.build(booking.bookingNumber)}">
```

Details

```
</a>
```

- Refactoring einfach
- Ressourcen können einfach umbenannt werden
- Nicht existierende Controller oder Methoden werden im Stacktrace genannt → einfaches Debugging
- **Keine Abhängigkeit zu konkreter Implementierung**

Buchung anlegen

GET http://<host>/mvc/bookings/new

MVC Bookings

New booking

Name

Save

Buchung anlegen

GET http://<host>/mvc/bookings/new

```
@Path("/bookings")
@Controller
public class BookingController {

    // ...

    @GET
    @Path("/new")
    public String showNewBookingForm() {
        return "form.jsp";
    }

    // ...
}
```

Buchung anlegen

GET http://<host>/mvc/bookings/new

```
<form method="post" action="{mvc.uri('BookingController#createNewBooking')}">
  <div class="form-row">
    <div class="col-md-6">
      <label for="name">Name</label>
      <input id="name" name="name" class="form-control" placeholder="Name of booking" required>
    </div>
  </div>
  <div class="form-row mt-2">
    <div class="col-md-3">
      <button type="submit" class="btn btn-primary">Save</button>
    </div>
  </div>
</form>
```


Booking anlegen mit POST

POST http://<host>/mvc/bookings

// ...

```
@Inject private BindingResult bindingResult;
```

```
@POST
```

```
public String createNewBooking(@MvcBinding @FormParam("name")  
    @NotBlank @Size(min = 5, max = 255) final String name) {
```

```
    if (bindingResult.isFailed()) {  
        models.put("errors", new ArrayList<>(bindingResult.getAllErrors()));  
        return "form.jsp";  
    }
```

```
    final var booking = bookingService.createNewBooking(name);
```

```
    return "redirect:/bookings/" + booking.getBookingNumber();
```

```
}
```

// ...

```
<input id="name" name="name" class="form-control"  
placeholder="Name of booking" required>
```



Fehlerbehandlung bei POST

POST http://<host>/mvc/bookings

```
<form method="post" action="{mvc.uri('BookingController#createNewBooking')}}" accept-charset="UTF-8">
  <div class="form-row">
    <div class="col-md-6">
      <label for="name">{msg.get("form.label.name")}</label>
      <input id="name" name="name" class="form-control" placeholder="{msg.get("form.label.name.placeholder")}" required>
    </div>
  </div>
  <c:choose>
    <c:when test="{not errors.isEmpty()}">
      <div class="row mt-2">
        <c:forEach var="error" items="{errors}">
          <div class="col-md-12">
            <div class="alert alert-danger">{error.getParamName()}: {error.getMessage()}</div>
          </div>
        </c:forEach>
      </div>
    </c:when>
  </c:choose>
  <div class="form-row mt-2">
    <div class="col-md-3">
      <button type="submit" class="btn btn-primary">{msg.get("form.btn.save")}</button>
    </div>
  </div>
</form>
```


Achtung: CSRF Gefahr!

CSRF-Protection

CSRF: Cross-Site Request Forgery

- Daten eines angemeldeten Benutzers werden von einem dritten Beteiligten verwendet, um durch untergeschobene URLs Schreibzugriffe durchzuführen.
- Schutz: Zufällig generiertes, verstecktes CSRF-Token

Buchung anlegen: Unsicher

GET http://<host>/mvc/bookings/new

```
<form method="post" action="{mvc.uri('BookingController#createNewBooking')}">
  <div class="form-row">
    <div class="col-md-6">
      <label for="name">Name</label>
      <input id="name" name="name" class="form-control" placeholder="Name of booking" required>
    </div>
  </div>
  <div class="form-row mt-2">
    <div class="col-md-3">
      <button type="submit" class="btn btn-primary">Save</button>
    </div>
  </div>
</form>
```


Welche Schutzmechanismen bietet MVC?

**Session-based
Token
(default)**

**Cookie-based
Token**

Explizite Konfiguration (default)

Implizite Konfiguration

Buchung anlegen: Token einfügen

GET http://<host>/mvc/bookings/new

```
<form method="post" action="{mvc.uri('BookingController#createNewBooking')}">
  <div class="form-row">
    <div class="col-md-6">
      <label for="name">Name</label>
      <input id="name" name="name" class="form-control" placeholder="Name of booking" required>
    </div>
  </div>
  <div class="form-row mt-2">
    <input type="hidden" name="{mvc.csrf.name}" value="{mvc.csrf.token}"/>

    <div class="col-md-3">
      <button type="submit" class="btn btn-primary">Save</button>
    </div>
  </div>
</form>
```

Buchung anlegen: Methode schützen

POST http://<host>/mvc/bookings

```
@POST
@CsrfProtected
public String createNewBooking(@MvcBinding @FormParam("name")
    @NotBlank @Size(min = 5, max = 255) final String name) {

    // ...
}
```


Buchung stornieren

GET http://<host>/mvc/bookings

MVC Bookings

Booking overview

New

Booking number	Name	Status		
cbf6880d-f9dc-4016-9411-b41faf7ab9fd	Augsburg -> München	Active	Details	Cancel
27360a91-915a-48d0-8162-8cebb14f4789	Berlin -> München	Cancelled	Details	Cancel
59e089a7-344c-4089-89c9-53ba0426e29f	München -> Augsburg	Active	Details	Cancel
71010fc9-546c-4652-8e17-b010bf61da0c	München -> Berlin	Cancelled	Details	Cancel

Buchung stornieren

DELETE http://<host>/mvc/bookings/{bookingNumber}

// ...

@DELETE

@Path("/{bookingNumber}")

public String cancelBooking(@PathParam("bookingNumber") final UUID bookingNumber) {

final var isCancelled = bookingService.cancelBooking(bookingNumber);

return isCancelled ? "redirect:/bookings" : "404.jsp";

}

// ...

Andere HTTP Methoden in Forms

(Krazo only)

Buchung stornieren

GET http://<host>/mvc/bookings

```
<form class="d-inline" method="post"
  action="${mvc.uriBuilder('BookingController#cancelBooking').build(booking.bookingNumber)}"
  onsubmit="return confirm('Do you really want to cancel the booking?');">

  <input type="hidden" name="_method" value="DELETE">

  <button type="submit" class="btn btn-link">Cancel</button>
</form>
```

Achtung:
PATCH Methode wird erst ab JAX-RS 2.1
unterstützt

Internationalisierung - LocaleResolver

```
/**
 * <p>Locale resolvers are used to determine the locale of the current request and are
 * discovered using CDI.
 *</p>
 *
 * ...
 */
public interface LocaleResolver {

    /**
     * <p>Resolve the locale of the current request given a {@link LocaleResolverContext}.</p>
     *
     * ...
     *
     * @param context the context needed for processing.
     * @return The resolved locale or <code>null</code>.
     */
    Locale resolveLocale(LocaleResolverContext context);
}
```


Internationalisierung - LocaleResolver

```
/**
 * <p>Locale resolvers are used to determine the locale of the current request and are
 * discovered using CDI.
 * </p>
 *
 * ...
 */
public interface LocaleResolver {

    /**
     * <p>Resolve the locale of the current request given a {@link LocaleResolverContext}.</p>
     *
     * ...
     *
     * @param context the context needed for processing.
     * @return The resolved locale or <code>null</code>.
     */
    Locale resolveLocale(LocaleResolverContext context);
}
```

- Default LocaleResolver muss vorhanden sein
- Auslesen des **Accept-Language** Headers als Quelle der Locale
- Ergebnis wird z.B. von `org.eclipse.krazo.locale.LocaleResolverChain` in `MvcContext` gesetzt

Internationalisierung - Übersetzungen

Beispiel: ResourceBundle messages für eine Anwendung

```
//messages.properties
```

```
...
```

```
#Index Page
```

```
page.title=My awesome application
```

```
#Hello World
```

```
hello.world=Hello World!
```

```
//messages_fr.properties
```

```
#Hello World
```

```
hello.world=Bonjour le monde!
```

```
//messages_de.properties
```

```
#Hello World
```

```
hello.world=Hallo Welt!
```


Internationalisierung – Übersetzung finden

Beispielhafte Implementierung

```
@RequestScoped
@Named("msg")
public class Messages {

    @Inject
    private MvcContext mvcContext;

    public final String get(final String key) {
        LOGGER.info(String.format("Getting message '%s' for locale '%s'", key,
                                   mvcContext.getLocale()));

        final var bundle = ResourceBundle.getBundle("messages", mvcContext.getLocale());

        return bundle.containsKey(key) ? bundle.getString(key) : formatUnknownKey(key);
    }

    private static String formatUnknownKey(final String key) {
        return String.format("???%s???", key);
    }
}
```

Internationalisierung – Übersetzung anwenden

```
<%@ page contentType="text/html; charset=UTF-8" language="java" %>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <title>${msg.get("page.title")}</title>
</head>
<body>
    <h1>${msg.get("hello.world")}</h1>
</body>
</html>
```

Internationalisierung - Übersetzungen

Beispiel: ResourceBundle *messages* für Booking Anwendung

//messages.properties

```
<html lang="en">
<head>
  <meta charset="UTF-8">
  <title>
    My awesome application
  </title>
</head>
<body>
  <h1>
    Hello World!
  </h1>
</body>
</html>
```

//messages_fr.properties

```
<html lang="en">
<head>
  <meta charset="UTF-8">
  <title>
    My awesome application
  </title>
</head>
<body>
  <h1>
    Bonjour le monde!
  </h1>
</body>
</html>
```

//messages_de.properties

```
<html lang="en">
<head>
  <meta charset="UTF-8">
  <title>
    My awesome application
  </title>
</head>
<body>
  <h1>
    Hallo Welt!
  </h1>
</body>
</html>
```

Mehr Details: https://www.mvc-spec.org/learn/cookbook/multilang_de.html

Danke! Fragen?

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Quellen & weiterführende Infos

- MVC Specification Homepage (<https://www.mvc-spec.org/>)
- JSR 371 (<https://jcp.org/en/jsr/detail?id=371>)
- MVC Users Mailing List (<https://groups.google.com/forum/#!forum/jsr371-users>)

- Eclipse Krazo Github Projekt (<https://github.com/eclipse-ee4j/krazo>)
- Jakarta EE 8 MVC Archetype (<https://github.com/erdlet/jakartaee8-mvc-archetype>)
- Booking-Applikation (<https://github.com/erdlet/mvc-krazo-talk-example>)
- MVC Cookbook(<https://www.mvc-spec.org/learn/cookbook/>)
- MVC Toolbox (<https://github.com/chkal/mvc-toolbox>)