Cascade Delete

Foreign key column

Table: instructor

id	first_name	last_name	instructor_detail_id
~~1~~	~~Chad~~	~~Darby~~	~~100~~
2	Madhu	Patel	200

Table: instructor_detail

id	youtube_channel	hobby
~~100~~	~~www.luv2code.com/youtube~~	~~Luv 2 Code!!!~~
200	www.youtube.com	Guitar

@OneToOne - Cascade Types

Cascade Type	Description
PERSIST	If entity is persisted / saved, related entity will also be persisted
REMOVE	If entity is removed / deleted, related entity will also be deleted
REFRESH	If entity is refreshed, related entity will also be refreshed
DETACH	If entity is detached (not associated w/ session), then related entity will also be detached
MERGE	If entity is merged, then related entity will also be merged
ALL	All of above cascade types

Configure Cascade Type

```
@Entity
@Table(name="instructor")
public class Instructor {
   ...

   @OneToOne(cascade=CascadeType.ALL)
   @JoinColumn(name="instructor_detail_id")
   private InstructorDetail instructorDetail;


   ...
   // constructors, getters / setters
}
```

By default, no operations are cascaded.

Configure Multiple Cascade Types

```
@OneToOne(cascade={CascadeType.DETACH,
                   CascadeType.MERGE,
                   CascadeType.PERSIST,
                   CascadeType.REFRESH,
                   CascadeType.REMOVE})
```

Step 4: Create Main App

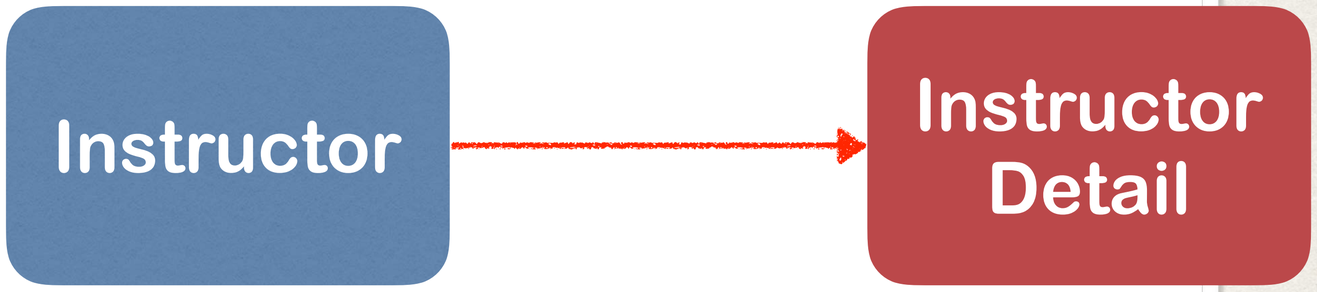
```
public static void main(String[] args) {
        ...

        ...
}
```

Step 4: Create Main App

```
public static void main(String[] args) {
        ...
        // create the objects
        Instructor tempInstructor = new Instructor("Chad", "Darby", "darby@luv2code.com");

        InstructorDetail tempInstructorDetail =
                new InstructorDetail("http://www.luv2code.com/youtube", "Luv 2 code!!!");









        ...
}
```

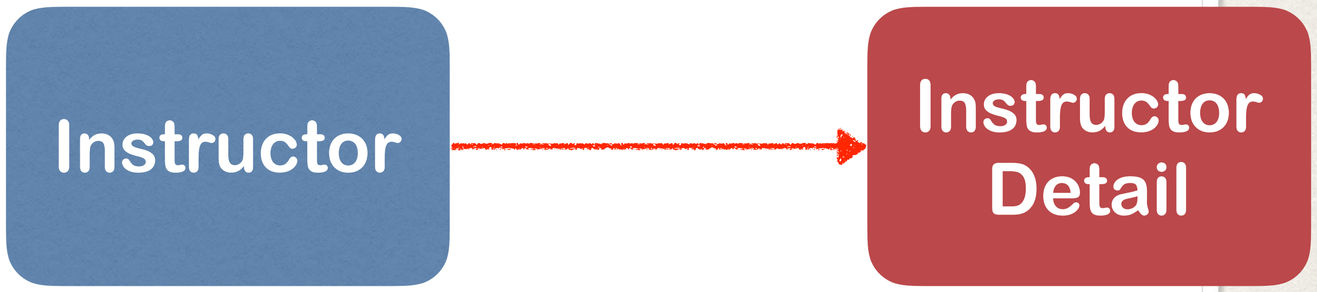
Step 4: Create Main App

```
public static void main(String[] args) {
        ...
        // create the objects
        Instructor tempInstructor = new Instructor("Chad", "Darby", "darby@luv2code.com");

        InstructorDetail tempInstructorDetail =
                new InstructorDetail("http://www.luv2code.com/youtube", "Luv 2 code!!!");

        // associate the objects
        tempInstructor.setInstructorDetail(tempInstructorDetail);

        ...
}
```



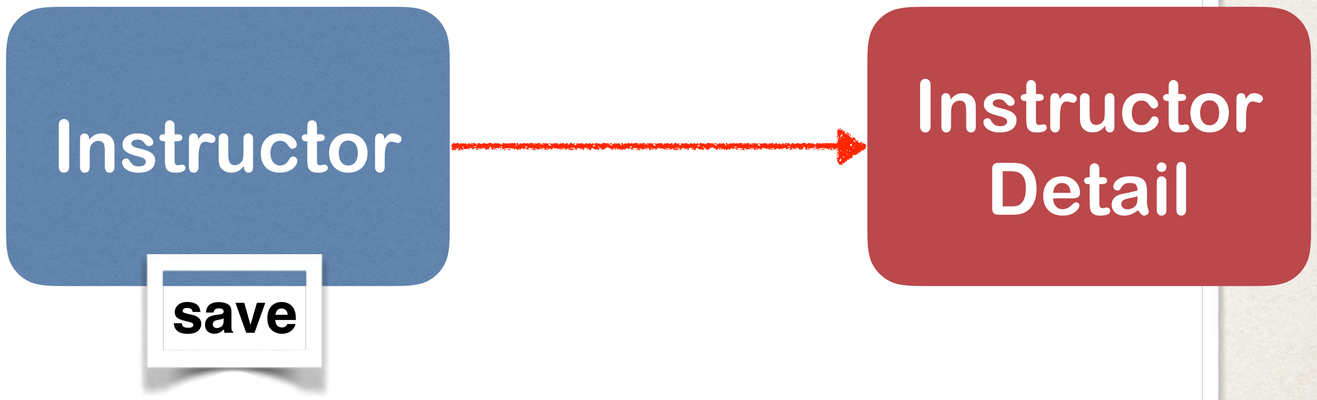
Step 4: Create Main App

```
public static void main(String[] args) {
    ...
    // create the objects
    Instructor tempInstructor = new Instructor("Chad", "Darby", "darby@luv2code.com");

    InstructorDetail tempInstructorDetail =
        new InstructorDetail("http://www.luv2code.com/youtube", "Luv 2 code!!!");

    // associate the objects
    tempInstructor.setInstructorDetail(tempInstructorDetail);

    // start a transaction
    session.beginTransaction();



    ...
}
```



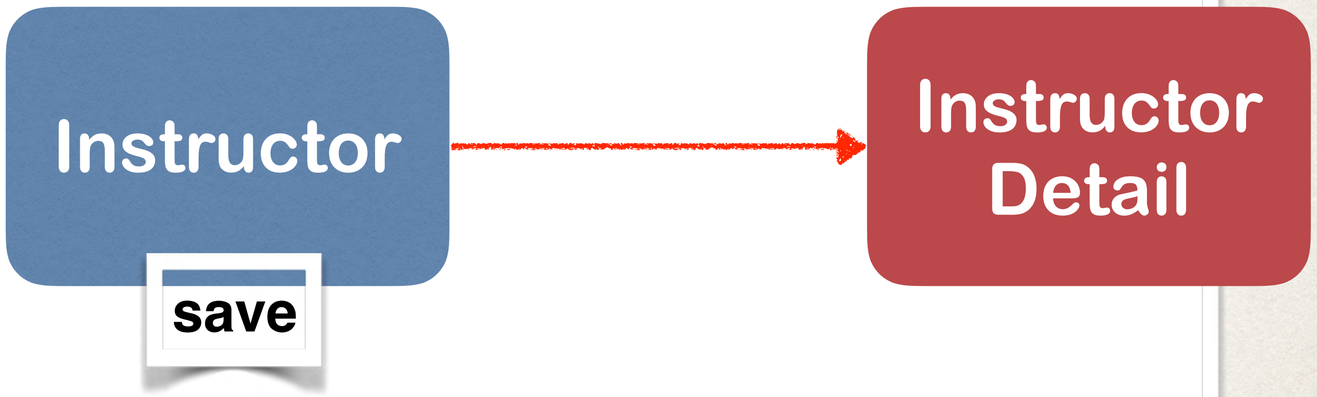
Step 4: Create Main App

```
public static void main(String[] args) {
        ...
        // create the objects
        Instructor tempInstructor = new Instructor("Chad", "Darby", "darby@luv2code.com");

        InstructorDetail tempInstructorDetail =
                new InstructorDetail("http://www.luv2code.com/youtube", "Luv 2 code!!!");

        // associate the objects
        tempInstructor.setInstructorDetail(tempInstructorDetail);

        // start a transaction
        session.beginTransaction();

        session.save(tempInstructor);



        ...
}
```



Step 4: Create Main App

```
public static void main(String[] args) {
    ...
    // create the objects
    Instructor tempInstructor = new Instructor("Chad", "Darby", "darby@luv2code.com");

    InstructorDetail tempInstructorDetail =
        new InstructorDetail("http://www.luv2code.com/youtube", "Luv 2 code!!!");

    // associate the objects
    tempInstructor.setInstructorDetail(tempInstructorDetail);

    // start a transaction
    session.beginTransaction();

    session.save(tempInstructor);

    // commit transaction
    session.getTransaction().commit();
    ...
}
```

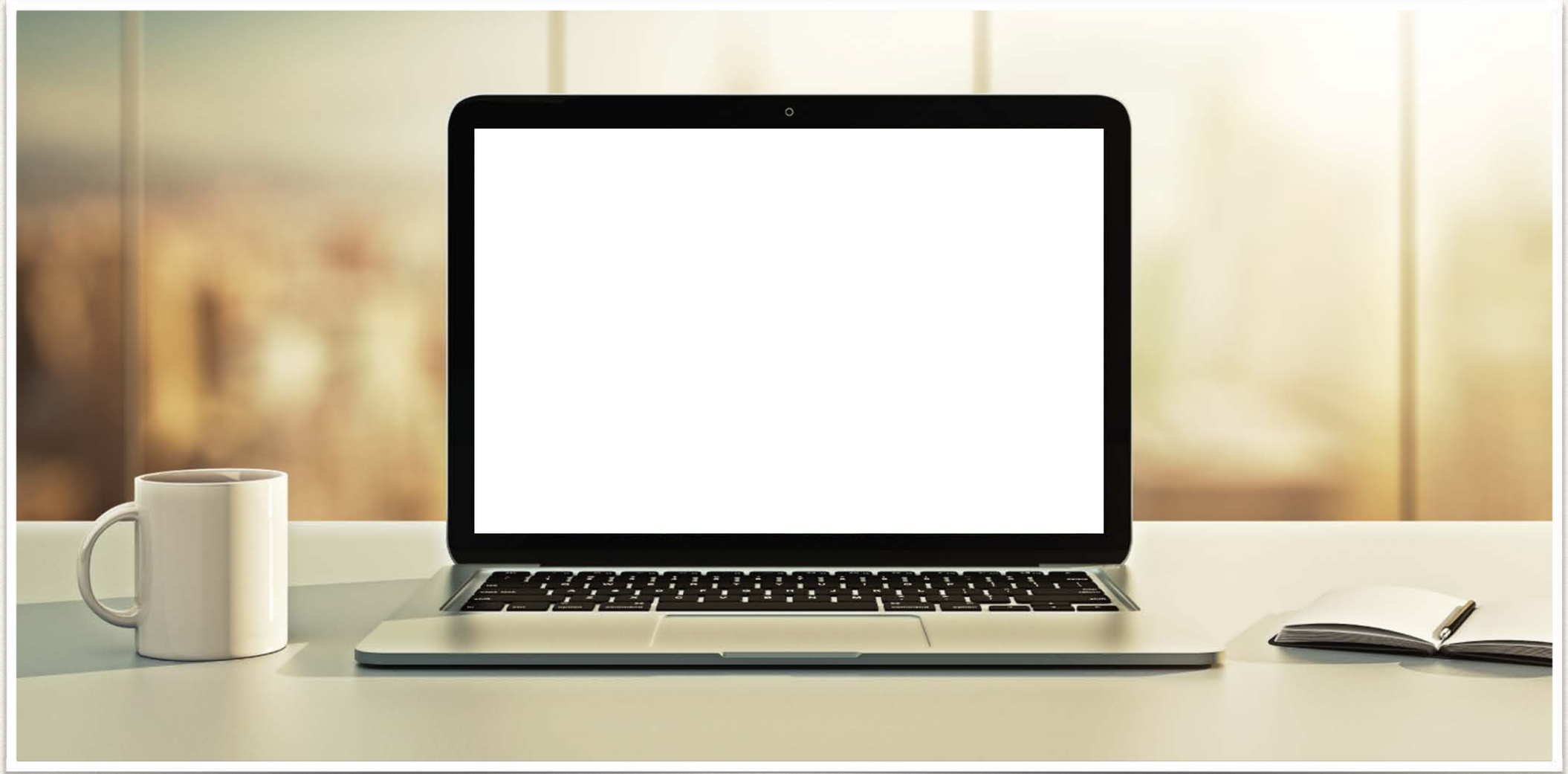


Development Process: One-to-One

Step-By-Step

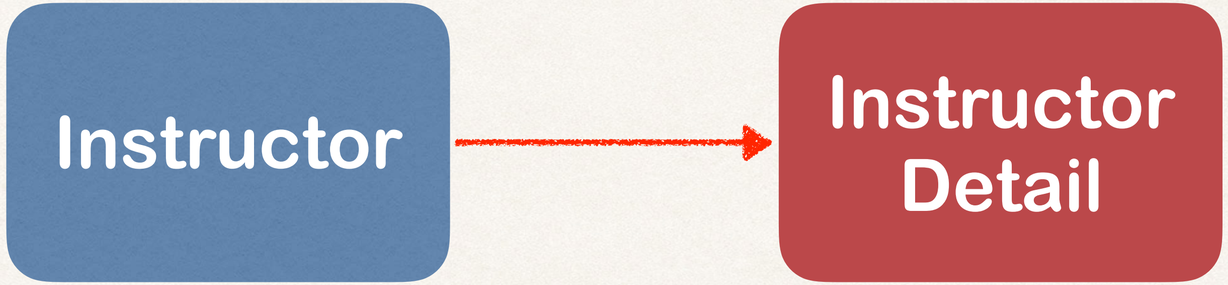
1. Prep Work
2. Create InstructorDetail class
3. Create Instructor class
4. Create Main App

Hibernate One-to-One Bi-Directional



One-to-One Mapping

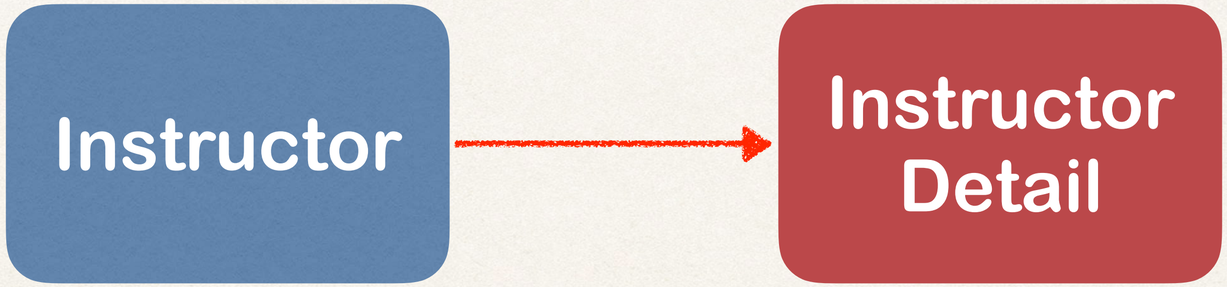
- We currently have a uni-directional mapping



New Use Case

- If we load an InstructorDetail
  - Then we'd like to get the associated Instructor

- Can't do this with current uni-directional relationship :-(



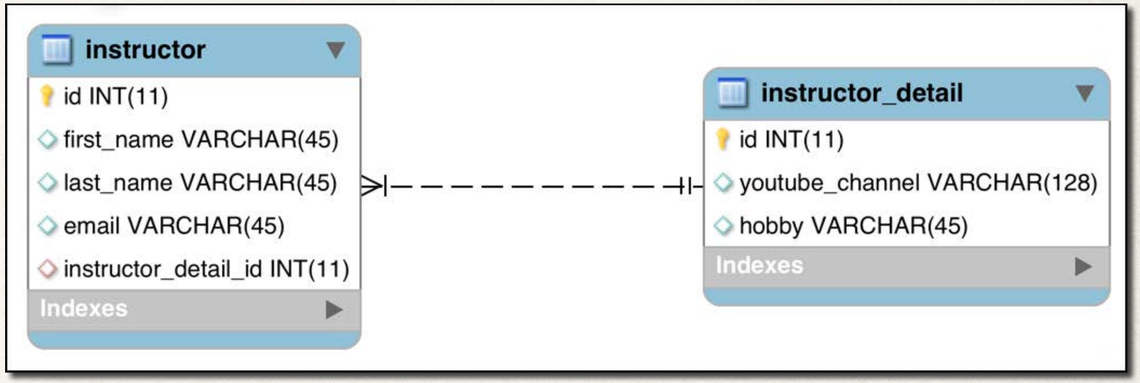
Bi-Directional

- Bi-Directional relationship is the solution

- We can start with InstructorDetail and make it back to the Instructor

Bi-Directional - The Good News

- To use Bi-Directional, we can keep the existing database schema
  - No changes required to database
- Simply update the Java code



Development Process: One-to-One (Bi-Directional)

Step-By-Step

1. Make updates to InstructorDetail class:
    1. Add new field to reference Instructor
    2. Add getter/setter methods for Instructor
    3. Add @OneToOne annotation

2. Create Main App

Step 1.1: Add new field to reference Instructor

```
@Entity
@Table(name="instructor_detail")
public class InstructorDetail {
    ...

    private Instructor instructor;

    ...
}
```

Step 1.2: Add getter/setter methods Instructor

```
@Entity
@Table(name="instructor_detail")
public class InstructorDetail {
    ...


    private Instructor instructor;

    public Instructor getInstructor() {
        return instructor;
    }

    public void setInstructor(Instructor instructor) {
        this.instructor = instructor;
    }
    ...

}
```

Step 1.3: Add @OneToOne annotation

```
@Entity
@Table(name="instructor_detail")
public class InstructorDetail {
   ...

   @OneToOne(mappedBy="instructorDetail")
   private Instructor instructor;

   public Instructor getInstructor() {
      return instructor;
   }

   public void setInstructor(Instructor instructor) {
      this.instructor = instructor;
   }
   ...

}
```

Refers to “instructorDetail” property in “Instructor” class

More on mappedBy

```
public class InstructorDetail {
    ...

    @OneToOne(mappedBy="instructorDetail")
    private Instructor instructor;
```

- **mappedBy** tells Hibernate
  - Look at the instructorDetail property in the Instructor class
  - Use information from the Instructor class @JoinColumn
  - To help find associated instructor

```
public class Instructor {
    ...

    @OneToOne(cascade=CascadeType.ALL)
    @JoinColumn(name="instructor_detail_id")
    private InstructorDetail instructorDetail;
```

Add support for Cascading

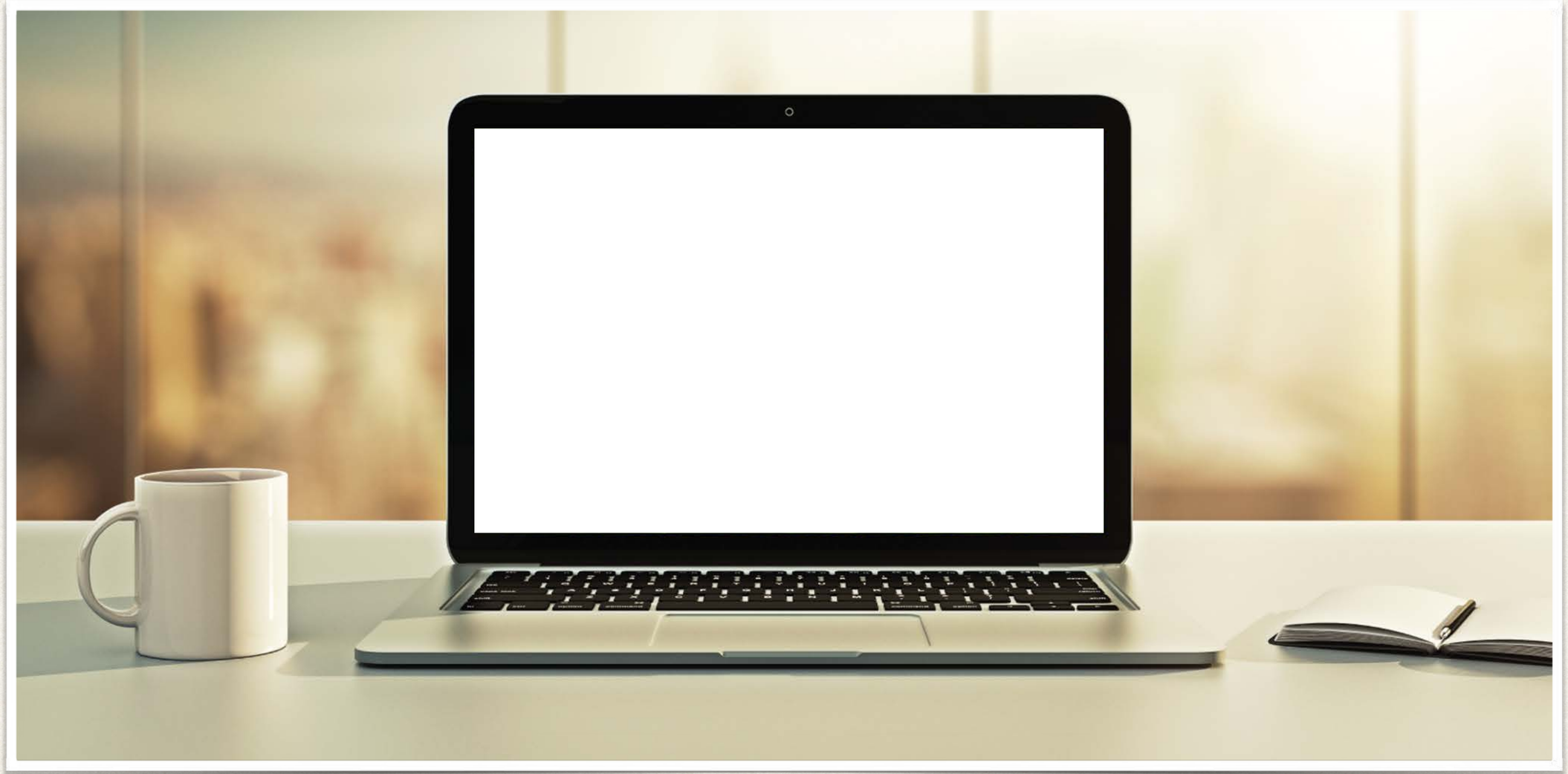
Cascade all operations
to the associated Instructor

```
@Entity
@Table(name="instructor_detail")
public class InstructorDetail {
   ...

   @OneToOne(mappedBy="instructorDetail", cascade=CascadeType.ALL)
   private Instructor instructor;

   public Instructor getInstructor() {
      return instructor;
   }

   public void setInstructor(Instructor instructor) {
      this.instructor = instructor;
   }
   ...

}
```

Step 2: Create Main App

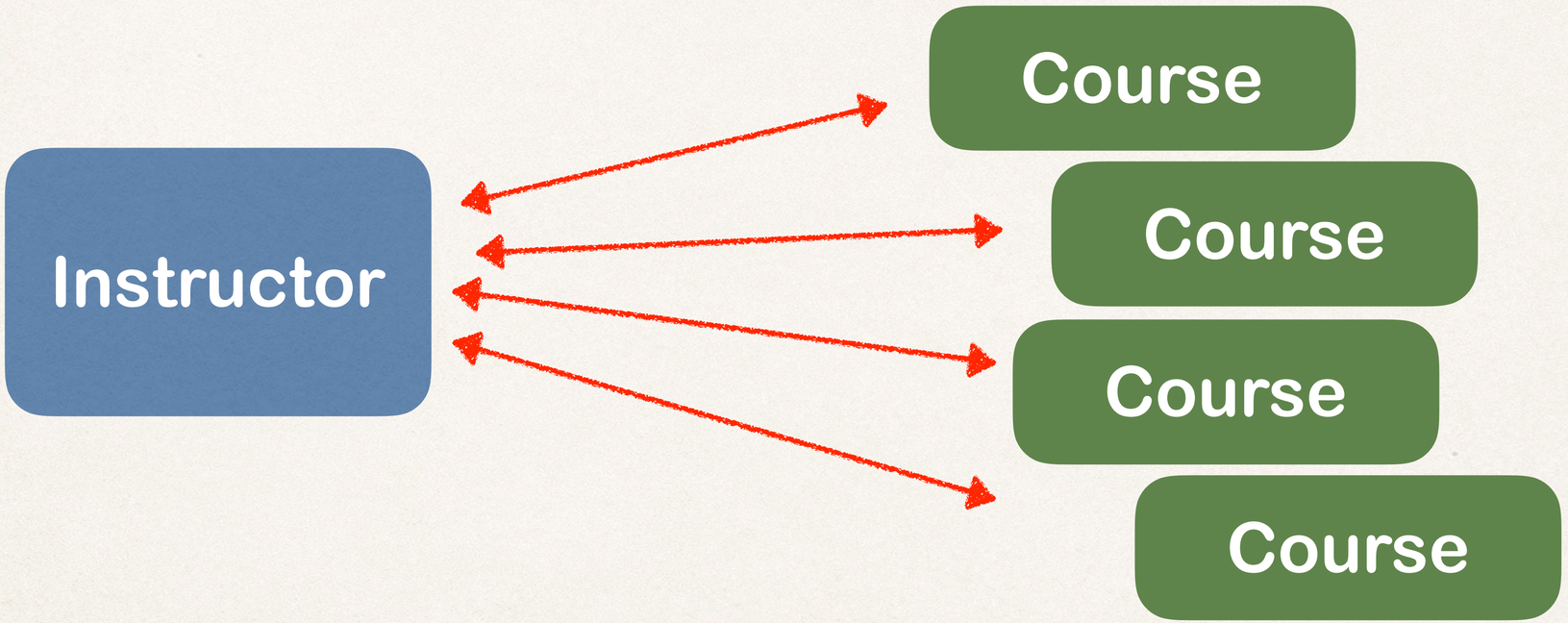
```
public static void main(String[] args) {
        ...

        // get the instructor detail object
        int theId = 1;
        InstructorDetail tempInstructorDetail = session.get(InstructorDetail.class, theId);

        // print detail
        System.out.println("tempInstructorDetail: " + tempInstructorDetail);

        // print the associated instructor
        System.out.println("the associated instructor: "
                                + tempInstructorDetail.getInstructor());
        ...
}
```

Hibernate One-to-Many Bi-Directional



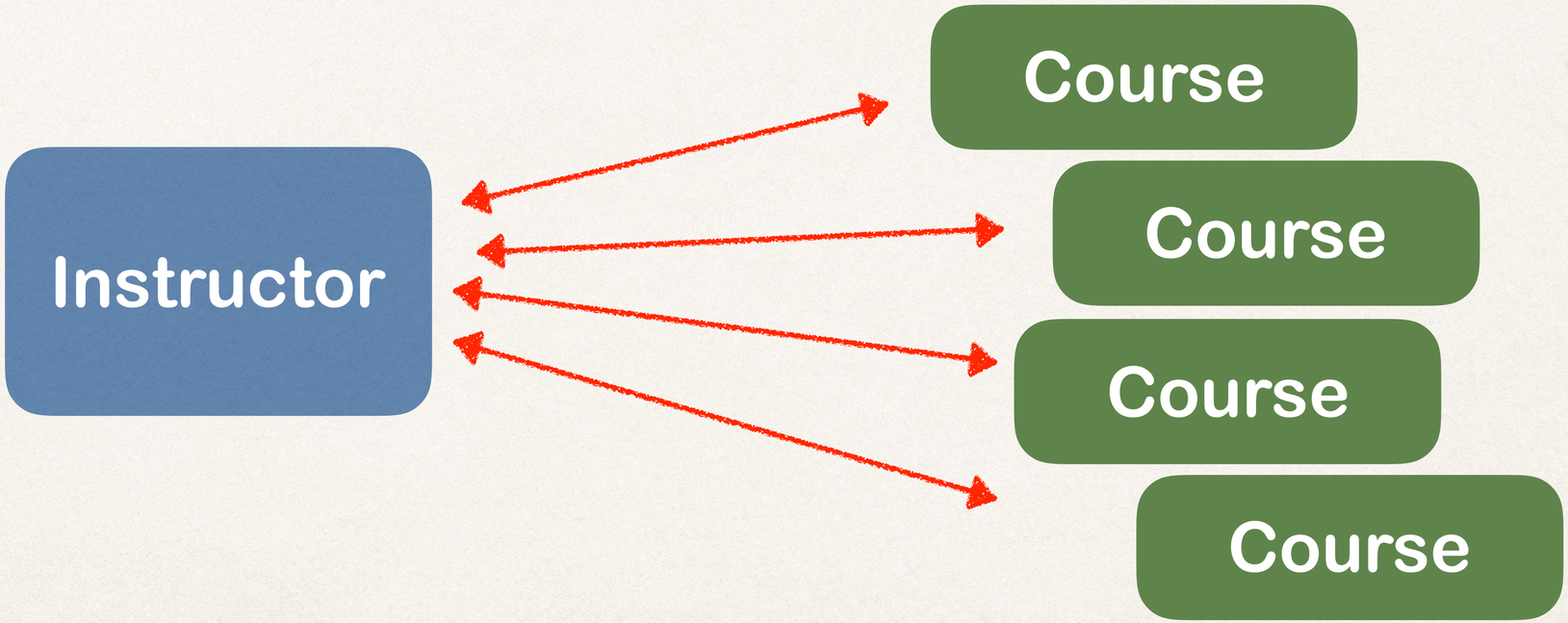
One-to-Many Mapping

- An instructor can have many courses
  - Bi-directional



Many-to-One Mapping

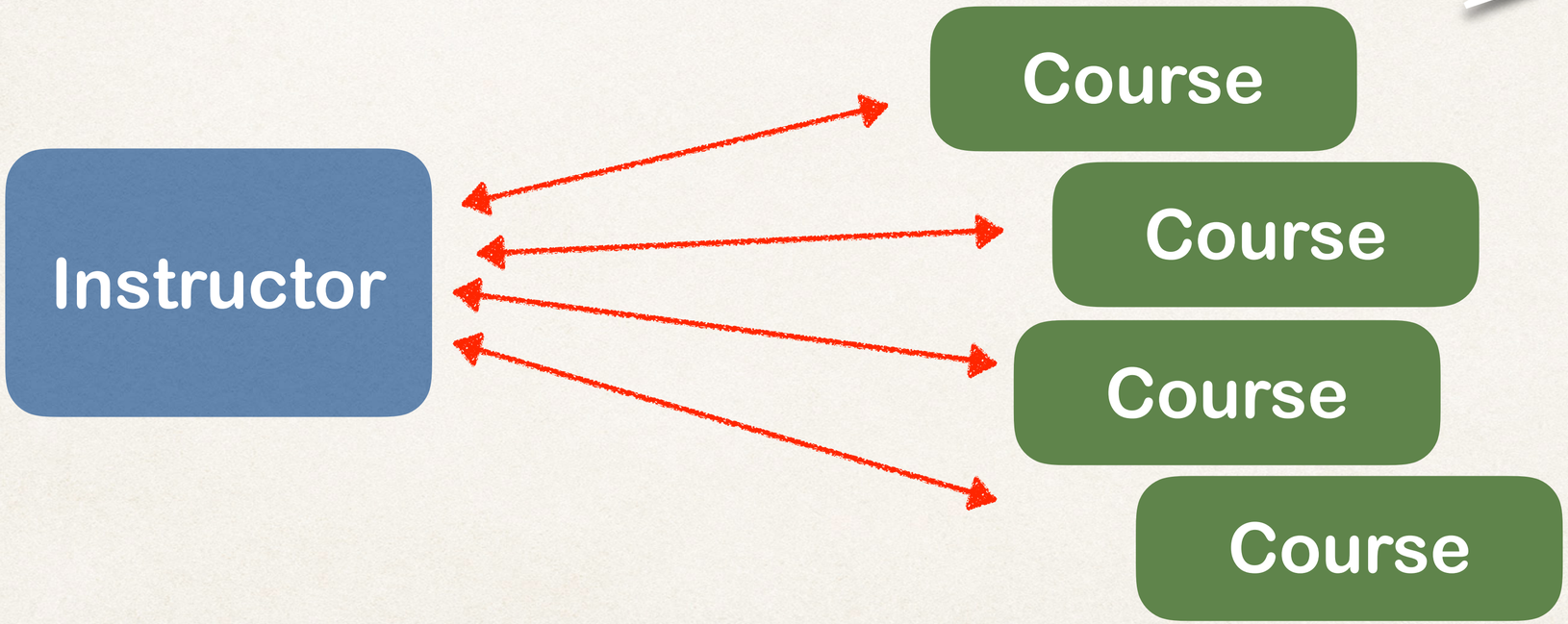
- Many courses can have one instructor
  - Inverse / opposite of One-to-Many



Real-World Project Requirement

- If you delete an instructor, DO NOT delete the courses
- If you delete a course, DO NOT delete the instructor

Do not apply cascading deletes!



Development Process: One-to-Many

Step-By-Step

1. Prep Work - Define database tables
2. Create Course class
3. Update Instructor class
4. Create Main App

table: course

File: create-db.sql

```
CREATE TABLE `course` (

  `id` int(11) NOT NULL AUTO_INCREMENT,
  `title` varchar(128) DEFAULT NULL,
  `instructor_id` int(11) DEFAULT NULL,

  PRIMARY KEY (`id`),

  UNIQUE KEY `TITLE_UNIQUE` (`title`),
    ...
);
```

Prevent duplicate course titles

table: course - foreign key

File: create-db.sql

```
CREATE TABLE `course` (
  ...
  KEY `FK_INSTRUCTOR_idx` (`instructor_id`),
  CONSTRAINT `FK_INSTRUCTOR`
  FOREIGN KEY (`instructor_id`)
  REFERENCES `instructor` (`id`)
  ...
);
```

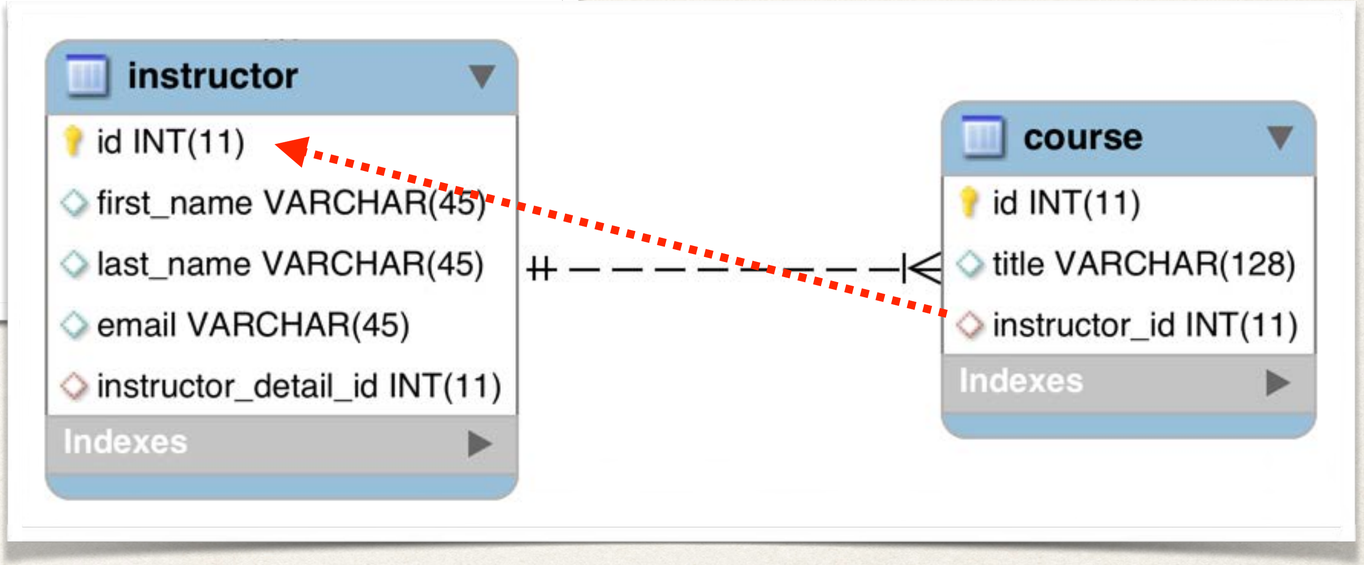
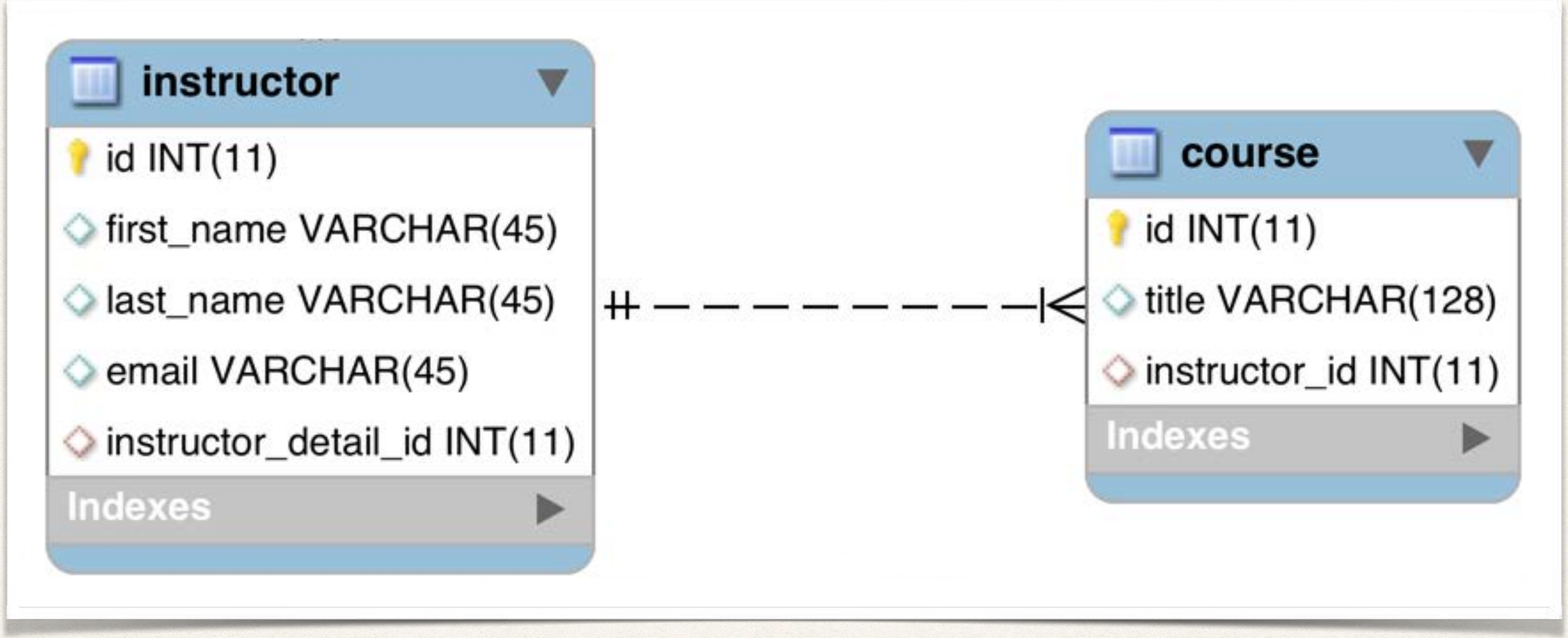


table: instructor - no changes

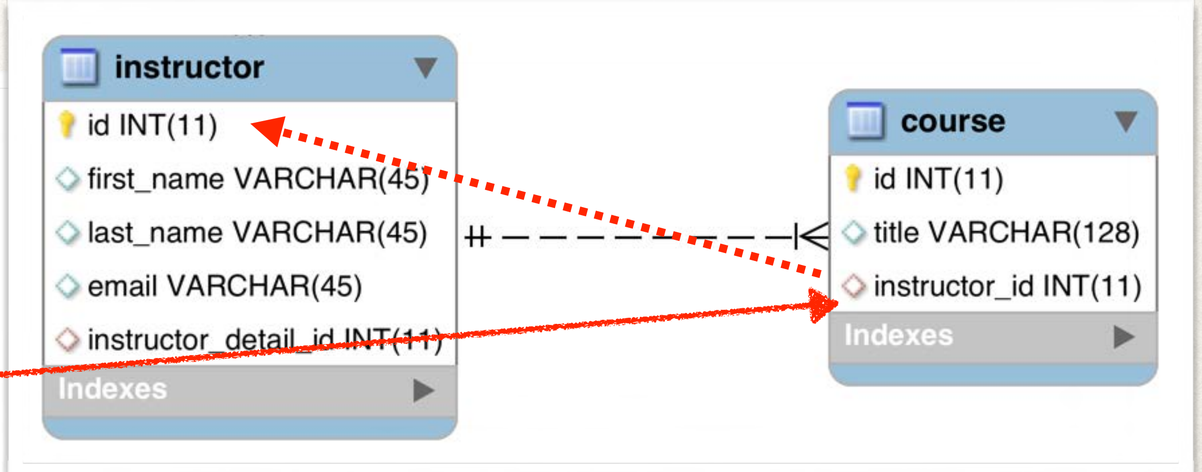


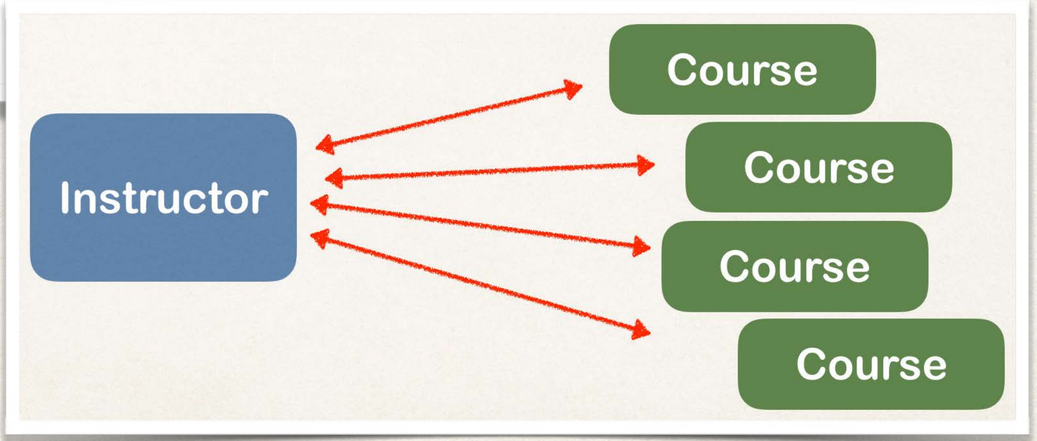
Step 2: Create Course class

```
@Entity
@Table(name="course")
public class Course {

    @Id
    @GeneratedValue(strategy=GenerationType.IDENTITY)
    @Column(name="id")
    private int id;

    @Column(name="title")
    private String title;

    ...
    // constructors, getters / setters
}
```

Step 2: Create Course class - @ManyToOne

```
@Entity
@Table(name="course")
public class Course {
    ...

    @ManyToOne
    @JoinColumn(name="instructor_id")
    private Instructor instructor;

    ...
    // constructors, getters / setters
}
```





Step 3: Update Instructor - reference courses

```
@Entity
@Table(name="instructor")
public class Instructor {
    ...

    private List<Course> courses;

    ...
}
```

Step 3: Update Instructor - reference courses

```
@Entity
@Table(name="instructor")
public class Instructor {
    ...

    private List<Course> courses;

    public List<Course> getCourses() {
        return courses;
    }

    public void setCourses(List<Course> courses) {
        this.courses = courses;
    }
    ...

}
```

Add @OneToMany annotation

```
@Entity
@Table(name="instructor")
public class Instructor {
   ...

   @OneToMany(mappedBy="instructor")
   private List<Course> courses;

   public List<Course> getCourses() {
      return courses;
   }

   public void setCourses(List<Course> courses) {
      this.courses = courses;
   }

   ...

}
```

Refers to “instructor” property in “Course” class

```
public class Instructor {
    ...

    @OneToMany(mappedBy="instructor")
    private List<Course> courses;
```

- **mappedBy** tells Hibernate
  - Look at the instructor property in the Course class
  - Use information from the Course class @JoinColumn
  - To help find associated courses for instructor

```
public class Course {
    ...

    @ManyToOne
    @JoinColumn(name="instructor_id")
    private Instructor instructor;
```

Add support for Cascading

```
@Entity
@Table(name="instructor")
public class Instructor {
   ...

   @OneToMany(mappedBy="instructor",
                  cascade={CascadeType.PERSIST, CascadeType.MERGE
                        CascadeType.DETACH, CascadeType.REFRESH})
   private List<Course> courses;



   ...

}
```

Do not apply cascading deletes!

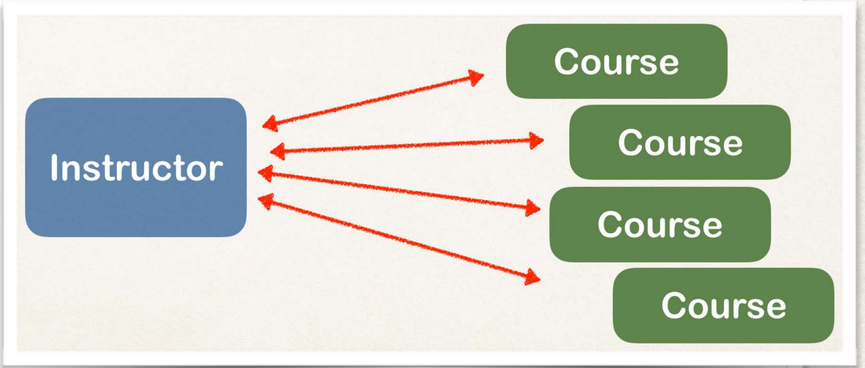
Add support for Cascading

```
@Entity
@Table(name="course")
public class Course {
   …

   @ManyToOne(cascade={CascadeType.PERSIST, CascadeType.MERGE
                       CascadeType.DETACH, CascadeType.REFRESH})
   @JoinColumn(name="instructor_id")
   private Instructor instructor;

   …
   // constructors, getters / setters
}
```

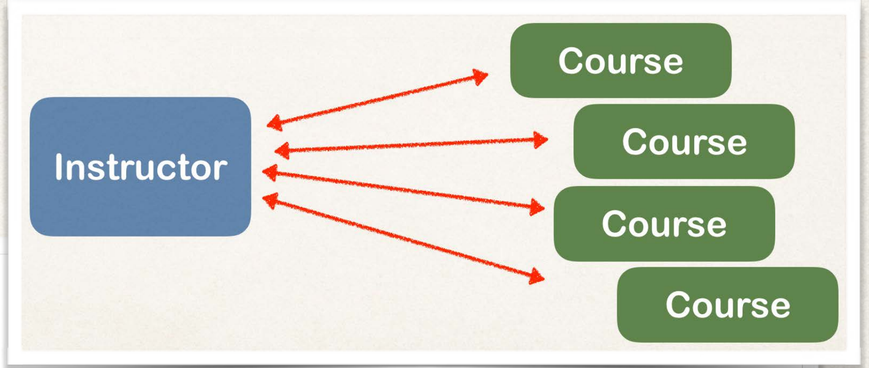
Do not apply cascading deletes!

Add convenience methods for bi-directional

```
@Entity
@Table(name="instructor")
public class Instructor {
   ...
   // add convenience methods for bi-directional relationship

   public void add(Course tempCourse) {

      if (courses == null) {
         courses = new ArrayList<>();
      }

      courses.add(tempCourse);

      tempCourse.setInstructor(this);
   }
   ...
}
```

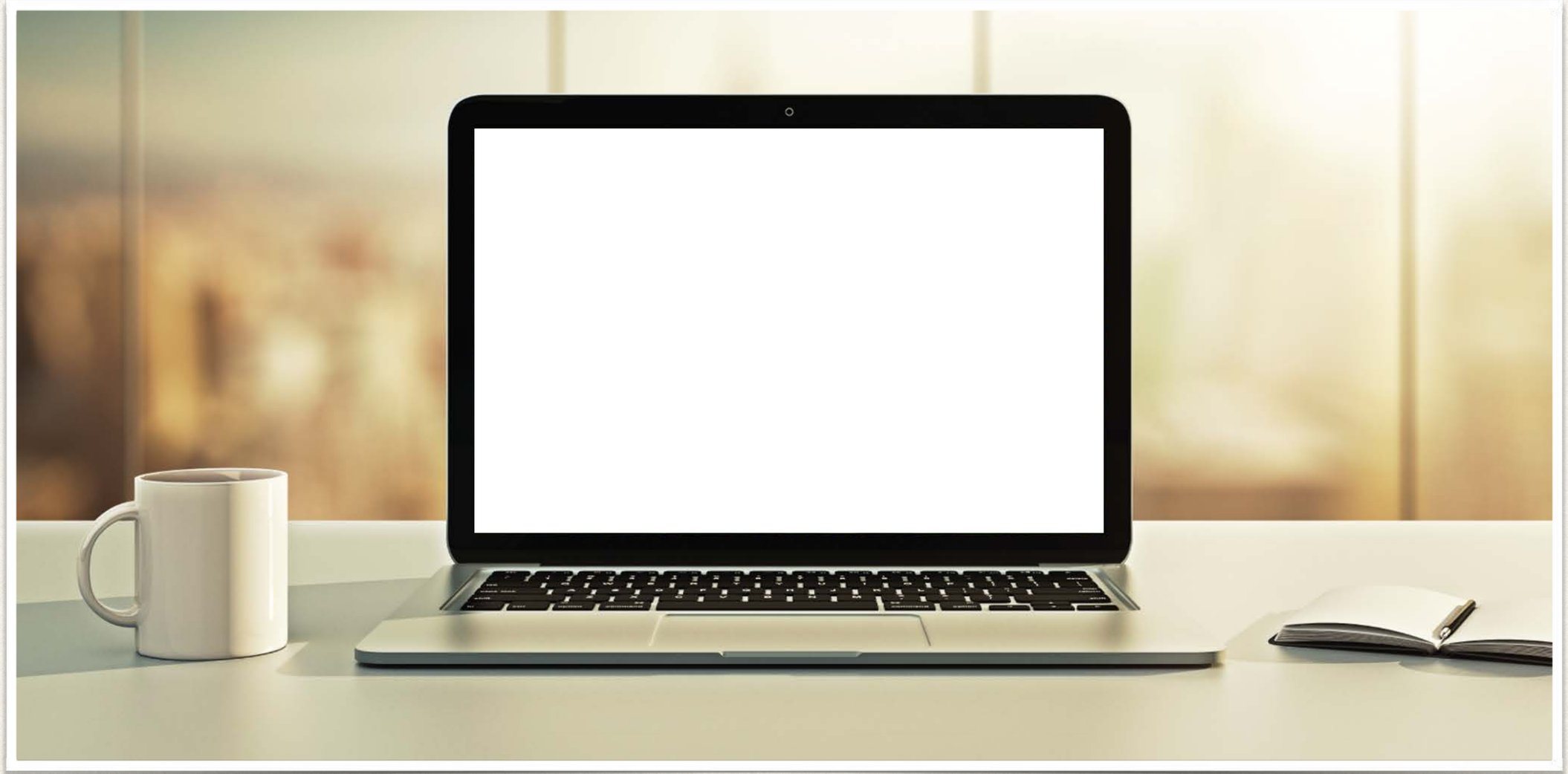


Step 2: Create Main App



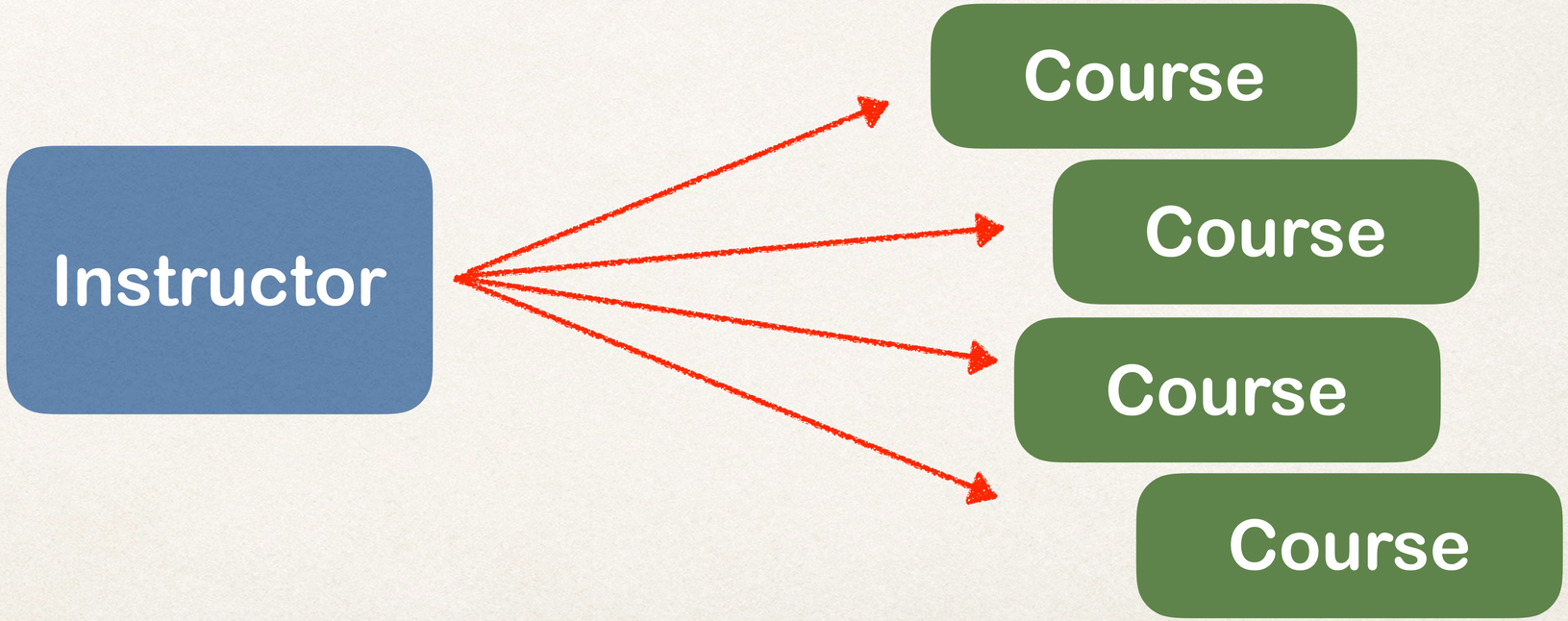

```
public static void main(String[] args) {
        ...

        // get the instructor object
        int theId = 1;
        Instructor tempInstructor = session.get(Instructor.class, theId);

        // print instructor
        System.out.println("tempInstructor: " + tempInstructor);

        // print the associated courses
        System.out.println("courses: " + tempInstructor.getCourses());
        ...
}
```

Fetch Types: Eager vs Lazy



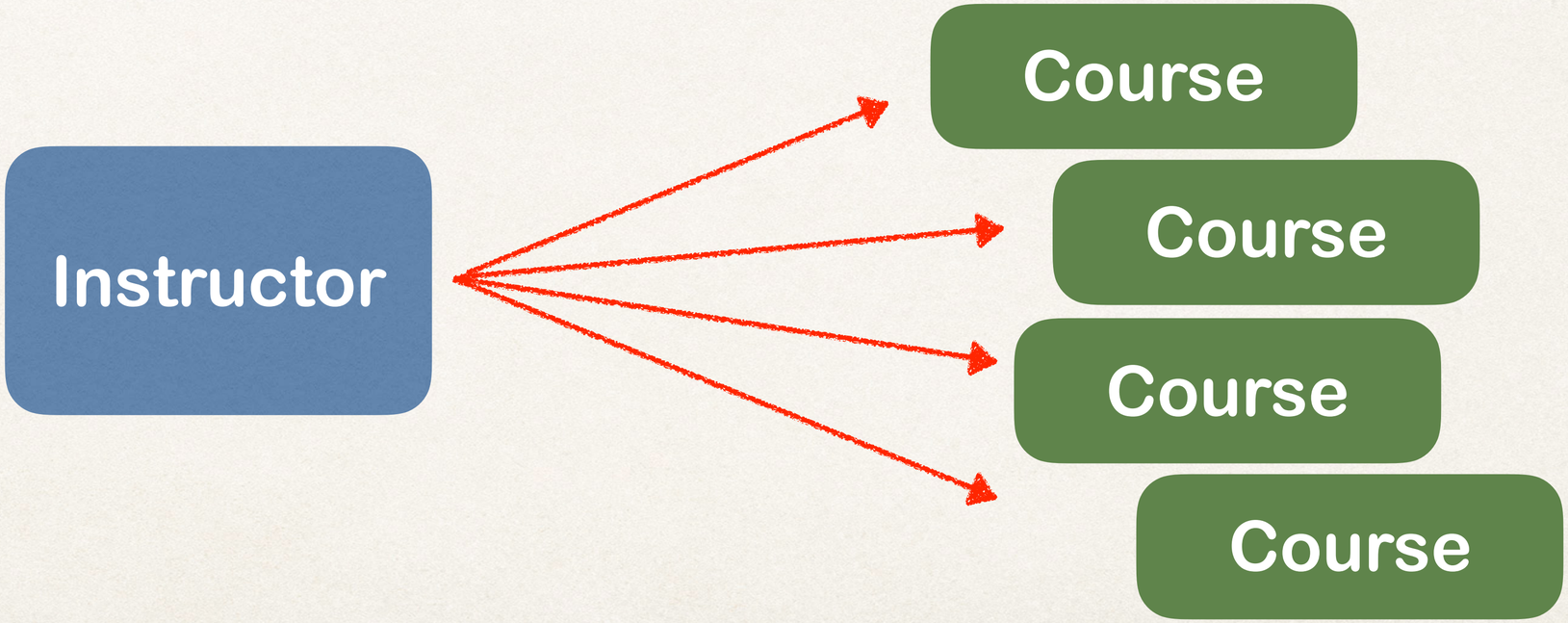
Fetch Types: Eager vs Lazy Loading

- When we fetch / retrieve data, should we retrieve EVERYTHING?
  - **Eager** will retrieve everything
  - **Lazy** will retrieve on request



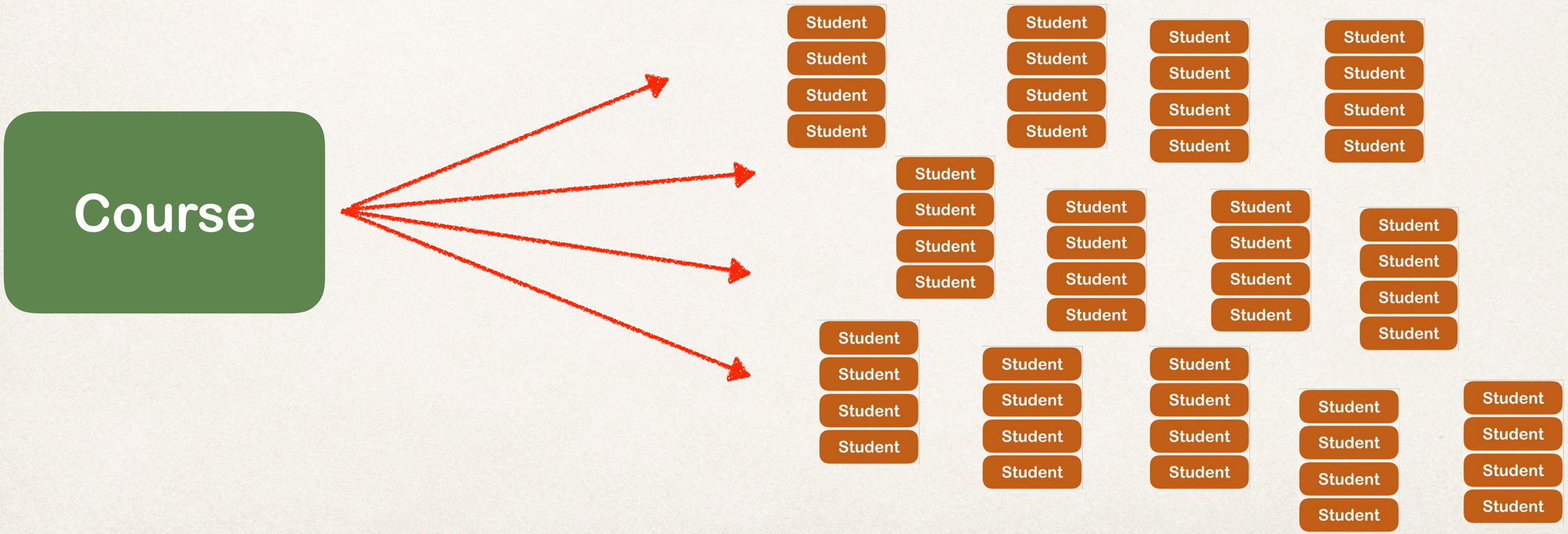
Eager Loading

- Eager loading will load all dependent entities
  - Load instructor and all of their courses at once



Eager Loading

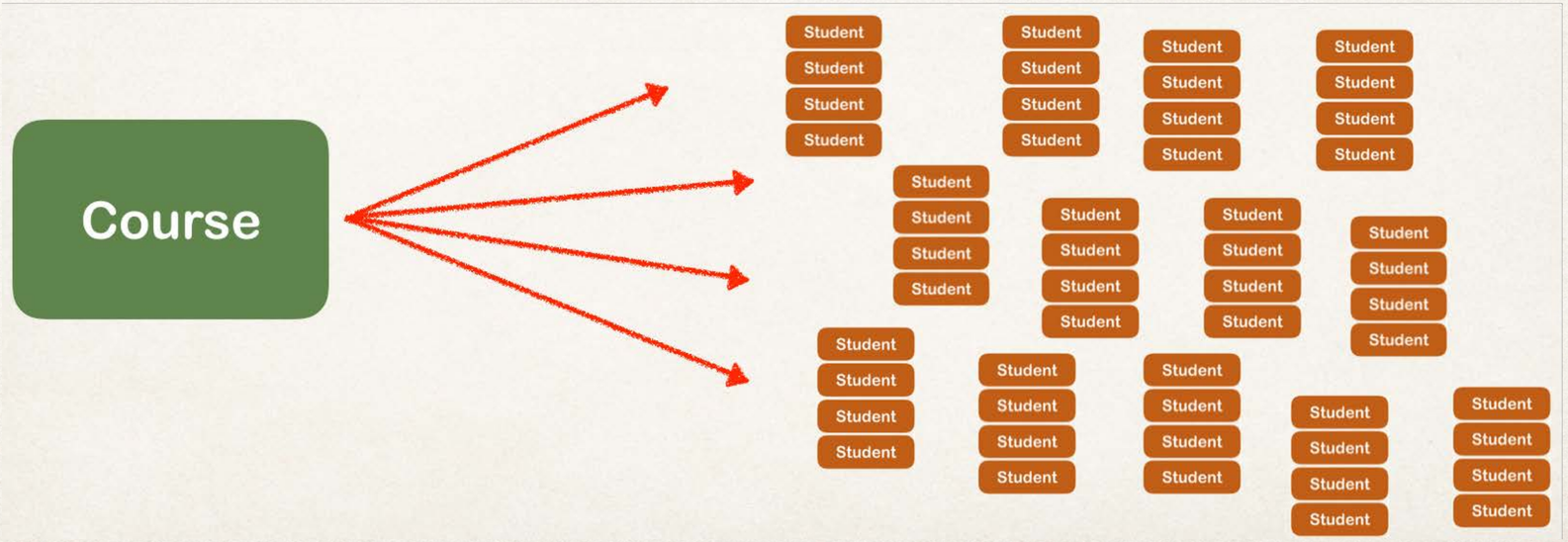
- What about course and students?
  - Could easily turn into a performance nightmare …



Eager Loading

- In our app, if we are searching for a course by keyword
  - Only want a list of matching courses

- Eager loading would still **load all students** for **each course** …. not good!



Best Practice

Only load data when absolutely needed

Prefer Lazy loading
instead of
Eager loading

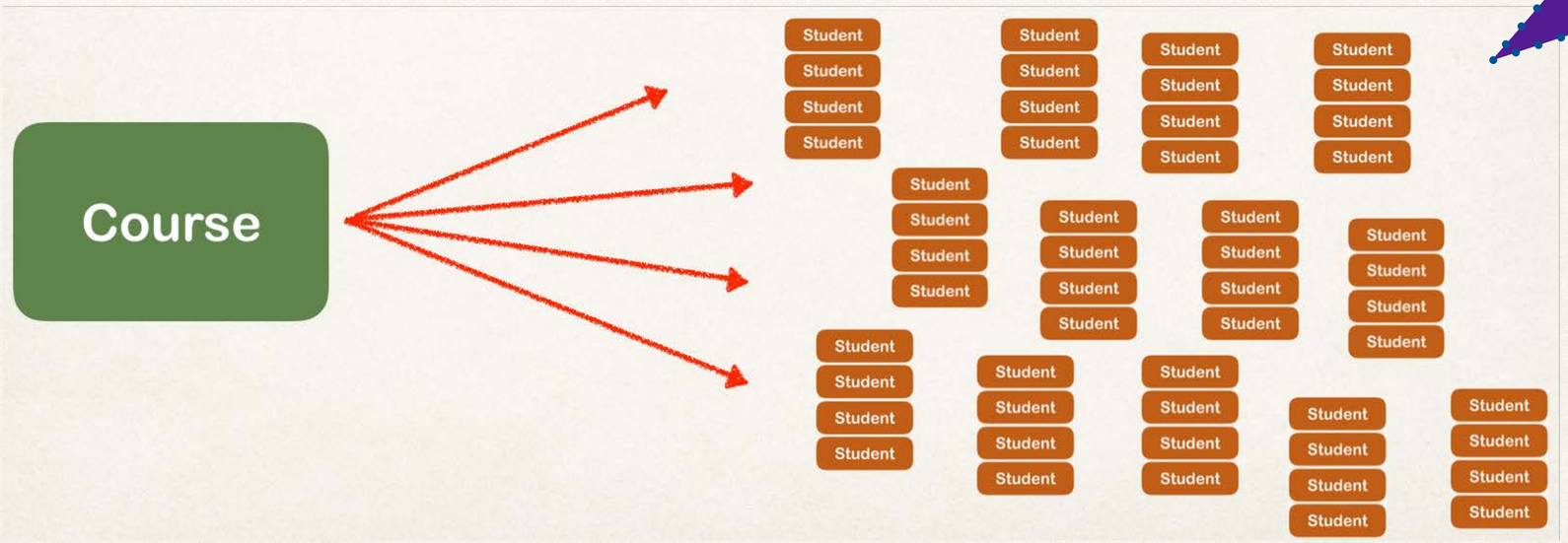
Lazy Loading

- Lazy loading will load the main entity first
  - Load dependent entities on demand (lazy)

Lazy Loading is preferred

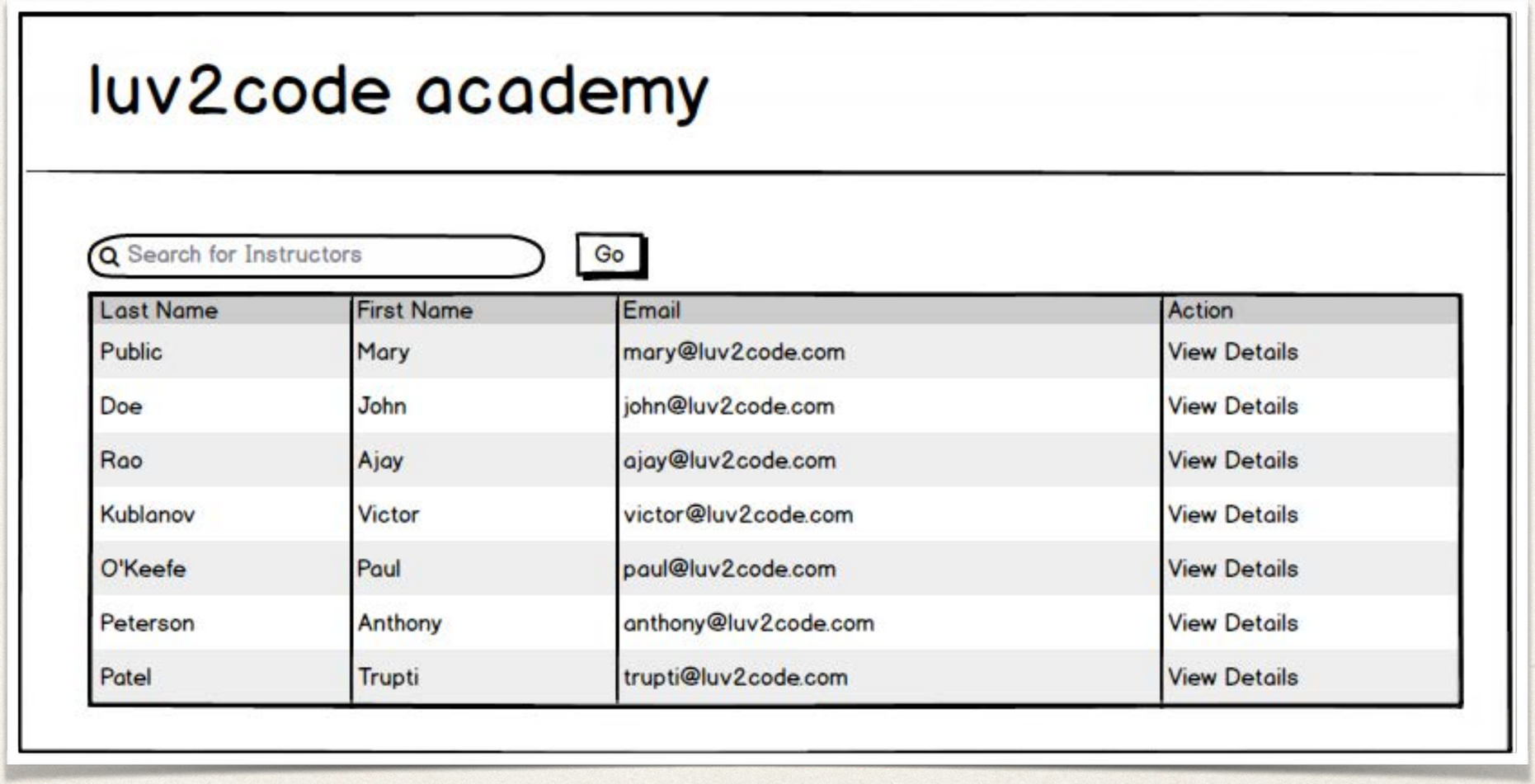
Load on demand (lazy)

Load course first



Real-World Use Case

- Search for instructors



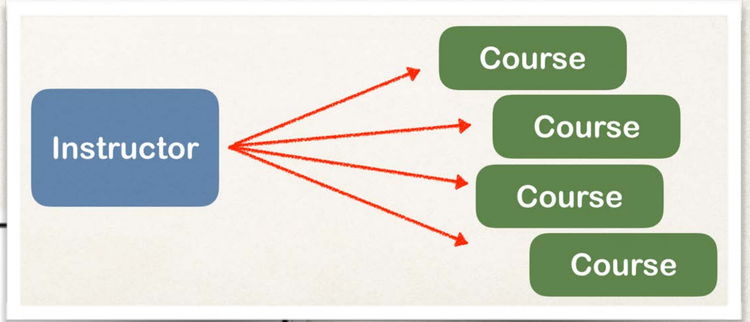
Last Name	First Name	Email	Action
Public	Mary	mary@luv2code.com	View Details
Doe	John	john@luv2code.com	View Details
Rao	Ajay	ajay@luv2code.com	View Details
Kublanov	Victor	victor@luv2code.com	View Details
O'Keefe	Paul	paul@luv2code.com	View Details
Peterson	Anthony	anthony@luv2code.com	View Details
Patel	Trupti	trupti@luv2code.com	View Details

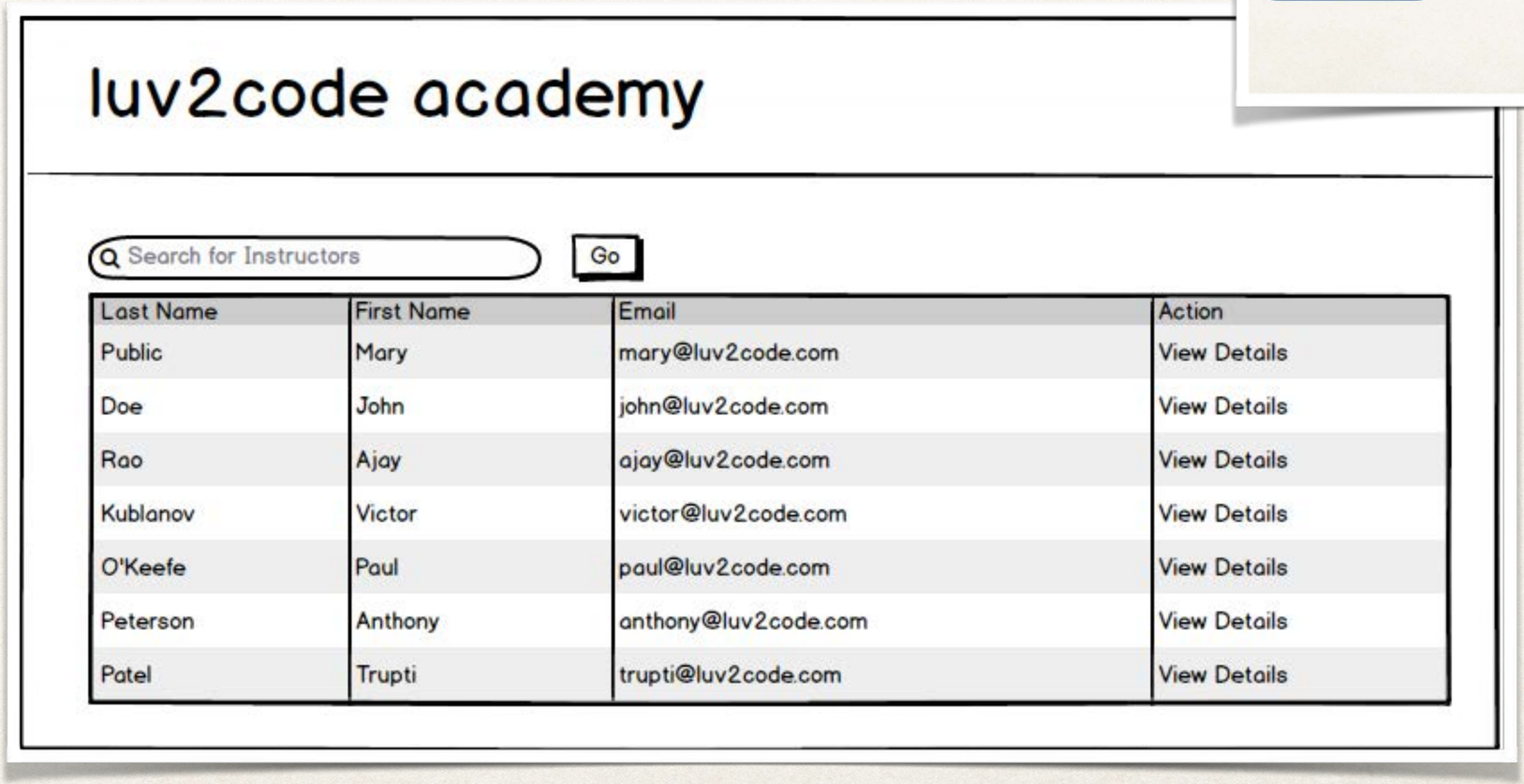
Real-World Use Case

- In Master view, use lazy loading
- In Detail view, retrieve the entity and necessary dependent entities

Real-World Use Case - Master View

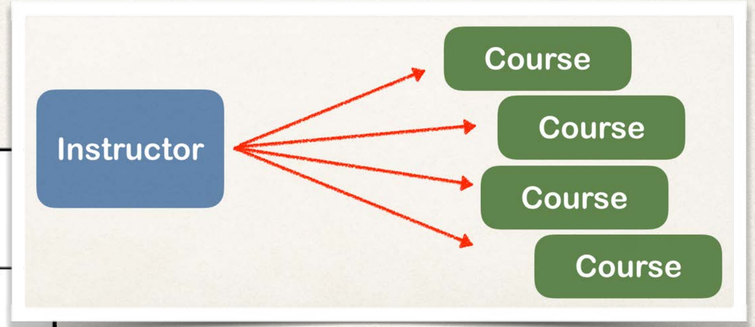
- In Master view, use lazy loading for search results
- Only load instructors … not their courses

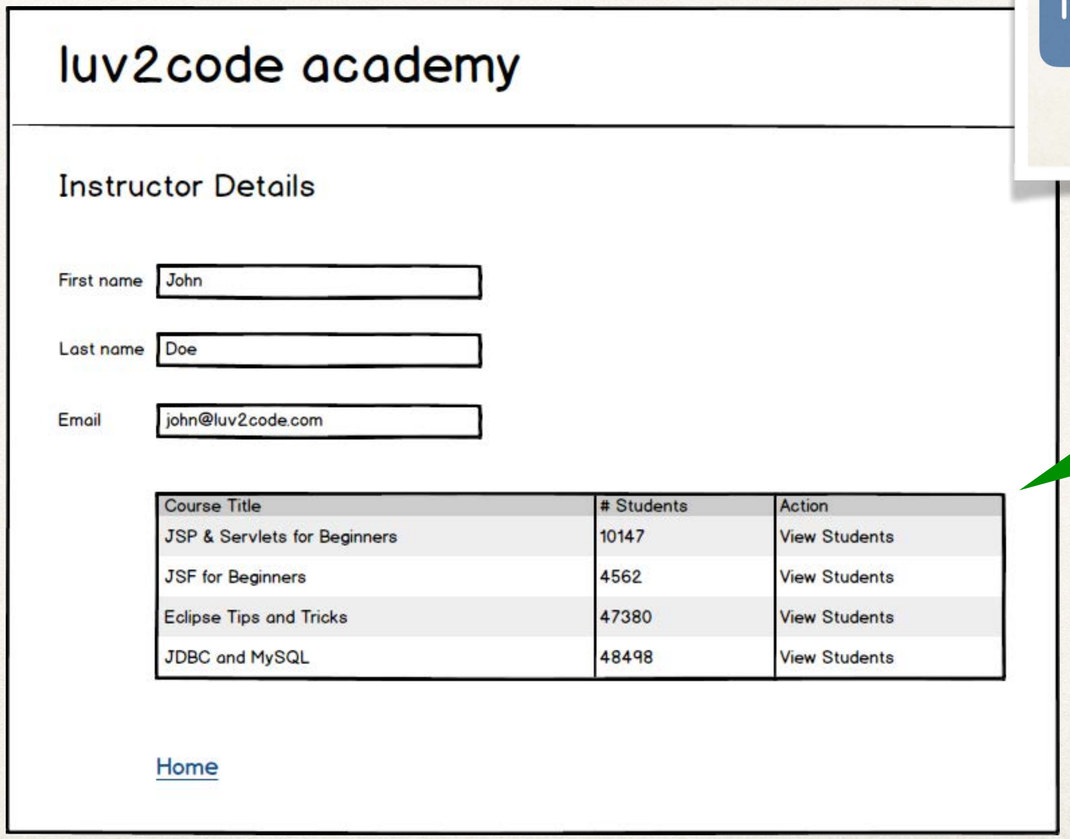




Real-World Use Case - Detail View

- In Detail view, retrieve the entity and necessary dependent entities
- Load instructor AND their courses

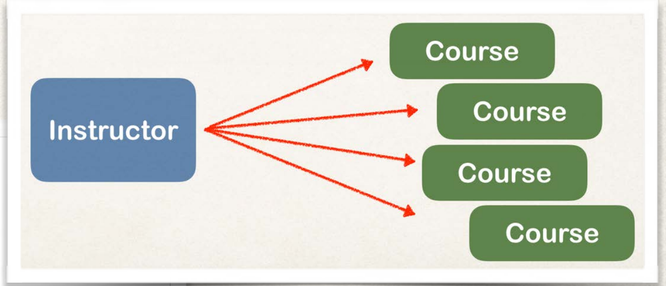




List of courses

Fetch Type

- When you define the mapping relationship
  - You can specify the fetch type: EAGER or LAZY




```
@Entity
@Table(name="instructor")
public class Instructor {
   ...

   @OneToMany(fetch=FetchType.LAZY, mappedBy="instructor")
   private List<Course> courses;

   ...

}
```

Default Fetch Types

Mapping	Default Fetch Type
@OneToOne	FetchType.EAGER
@OneToMany	FetchType.LAZY
@ManyToOne	FetchType.EAGER
@ManyToMany	FetchType.LAZY

Overriding Default Fetch Type

- Specifying the fetch type, overrides the defaults

Mapping	Default Fetch Type
@ManyToOne	FetchType.EAGER

```
@ManyToOne(fetch=FetchType.LAZY)
@JoinColumn(name="instructor_id")
private Instructor instructor;
```

More about Lazy Loading

- When you lazy load, the data is only retrieved on demand
- However, this requires an open Hibernate session
  - need an connection to database to retrieve data

More about Lazy Loading

- If the Hibernate session is closed
  - And you attempt to retrieve lazy data
  - Hibernate will throw an exception

Watch out for this!

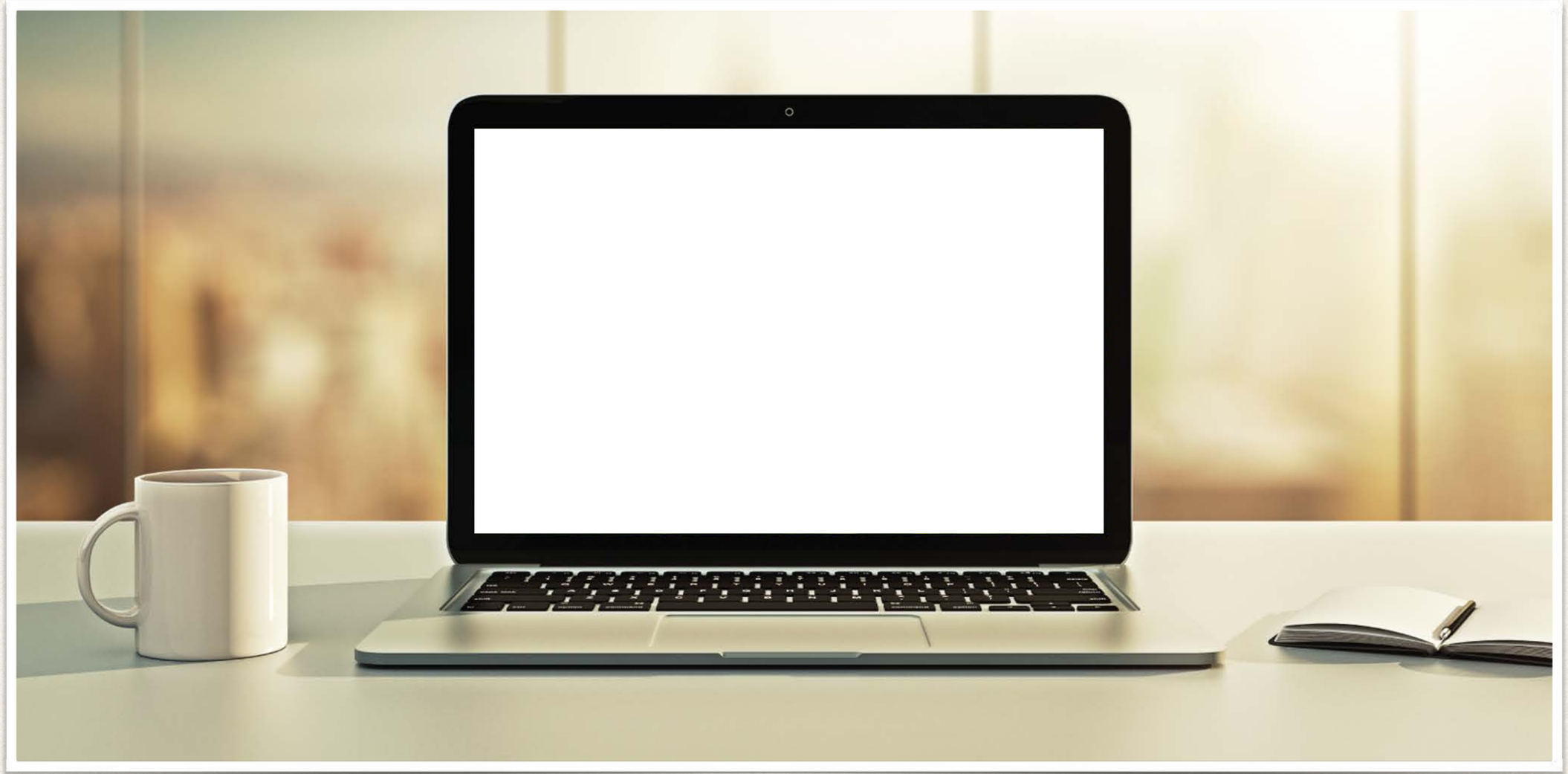
More about Lazy Loading

- To retrieve lazy data, you will need to open a Hibernate session

- Retrieve lazy data using
  - Option 1: session.get and call appropriate getter method(s)
  - Option 2: Hibernate query with HQL

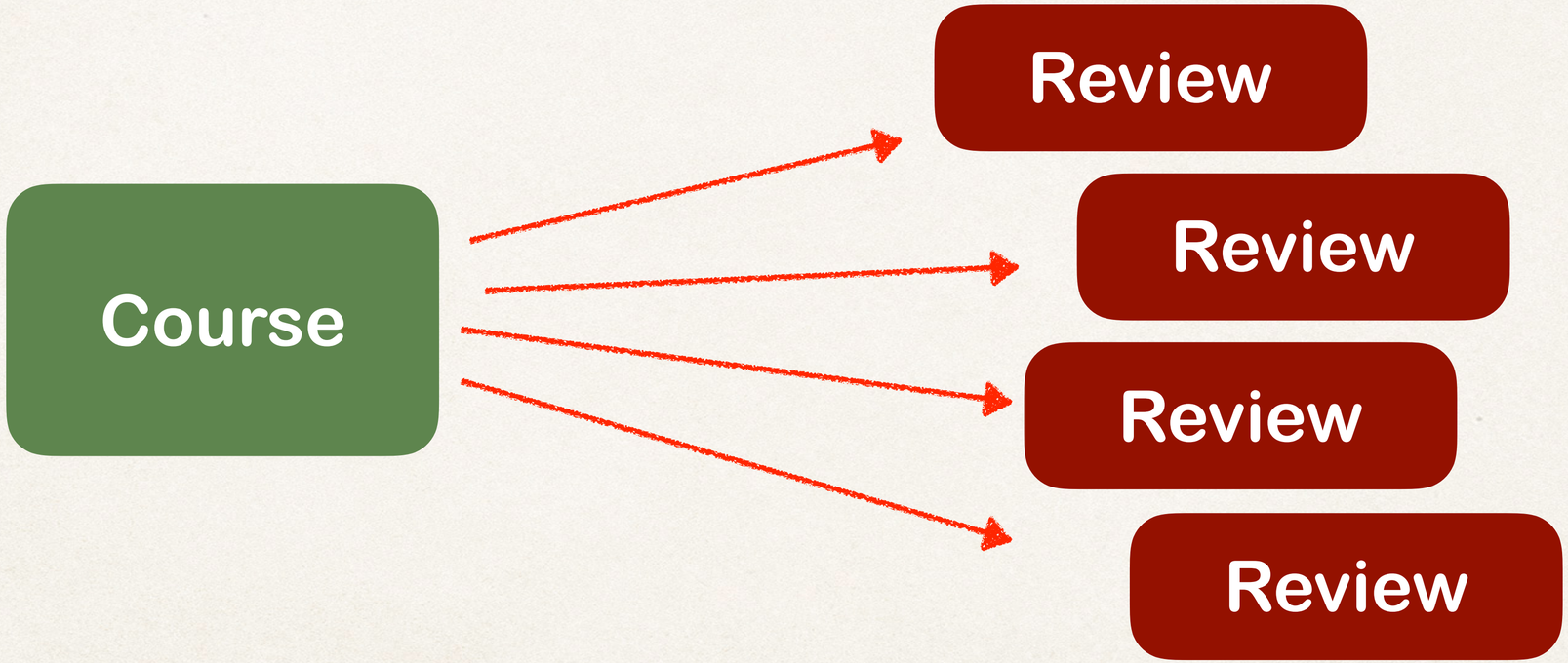
- Many other techniques available but the two above are most common

Hibernate One-to-Many Uni-Directional



One-to-Many Mapping

- A course can have many reviews
  - Uni-directional



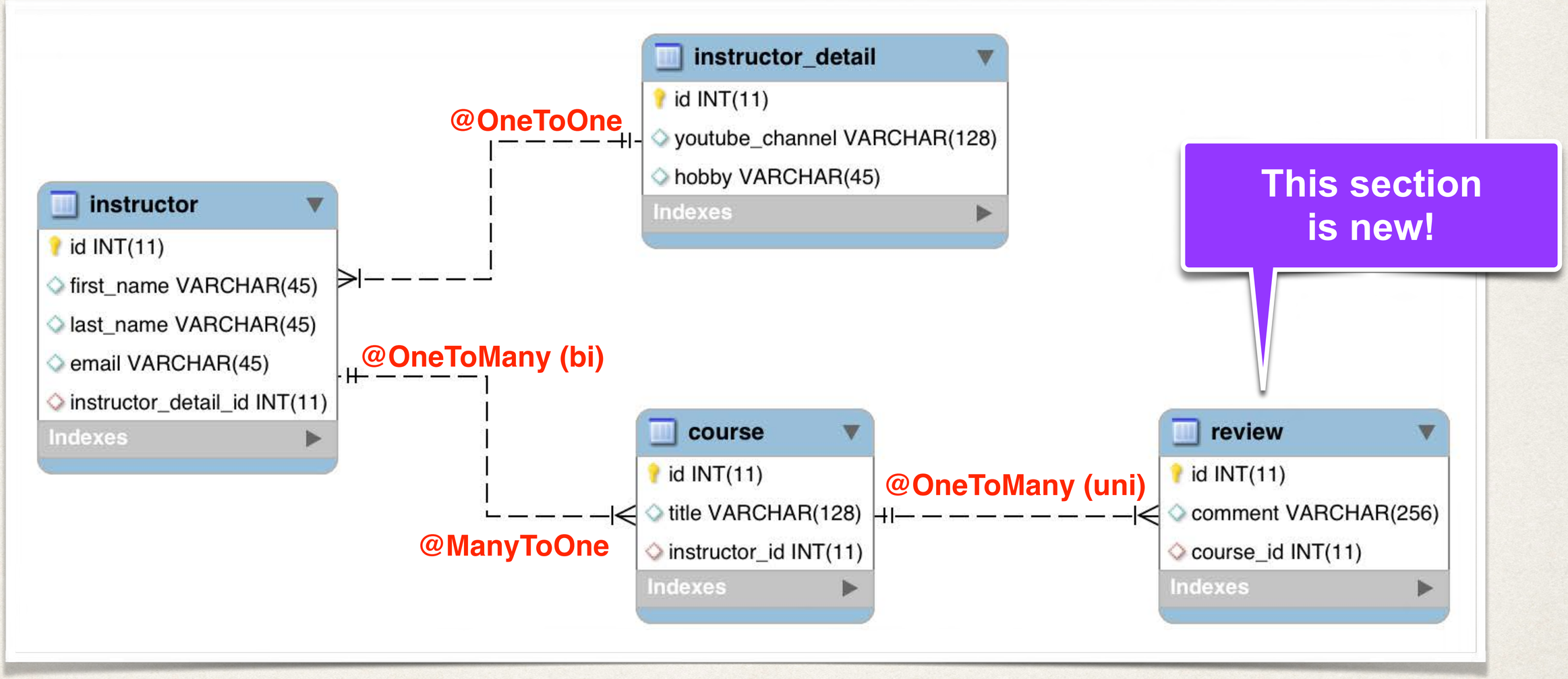
Real-World Project Requirement

- If you delete a course, also delete the reviews
- Reviews without a course … have no meaning

@OneToMany

course
id INT(11)
title VARCHAR(128)
instructor_id INT(11)
Indexes
@OneToMany (uni)
review
id INT(11)
comment VARCHAR(256)
course_id INT(11)
Indexes

Look Mom … our project is growing!



Development Process: One-to-Many

Step-By-Step

1. Prep Work - Define database tables
2. Create **Review** class
3. Update **Course** class
4. Create Main App

table: review

File: create-db.sql

```
CREATE TABLE `review` (

  `id` int(11) NOT NULL AUTO_INCREMENT,
  `comment` varchar(256) DEFAULT NULL,
  `course_id` int(11) DEFAULT NULL,

   ...
);
```

comment:
"Wow … this course is awesome!"

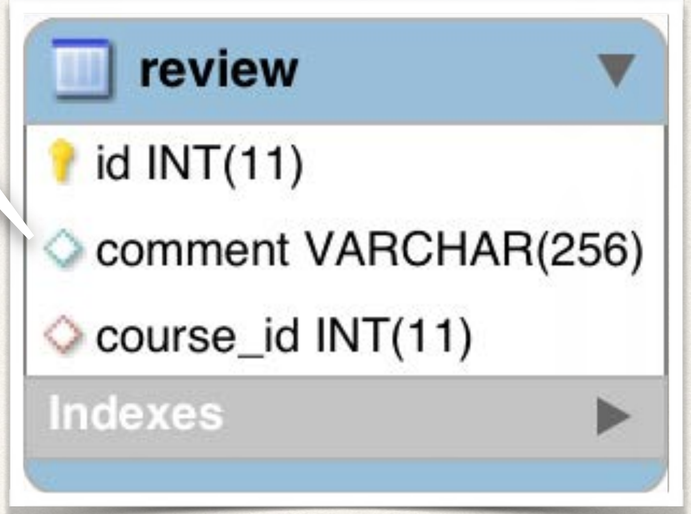


table: review - foreign key

File: create-db.sql

```
CREATE TABLE `review` (
  ...
  KEY `FK_COURSE_ID_idx` (`course_id`),
  CONSTRAINT `FK_COURSE`
  FOREIGN KEY (`course_id`)
  REFERENCES `course` (`id`)
  ...
);
```

Table

Column

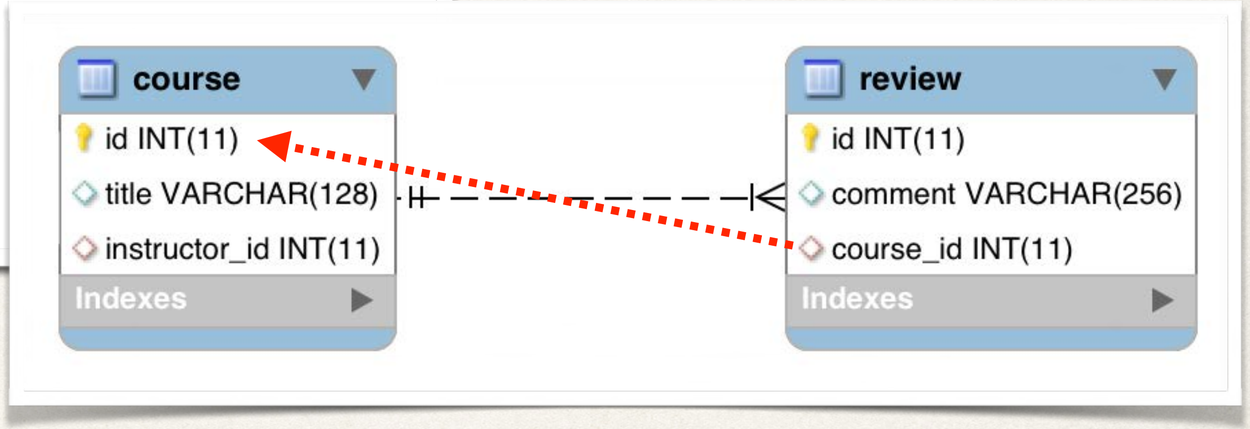
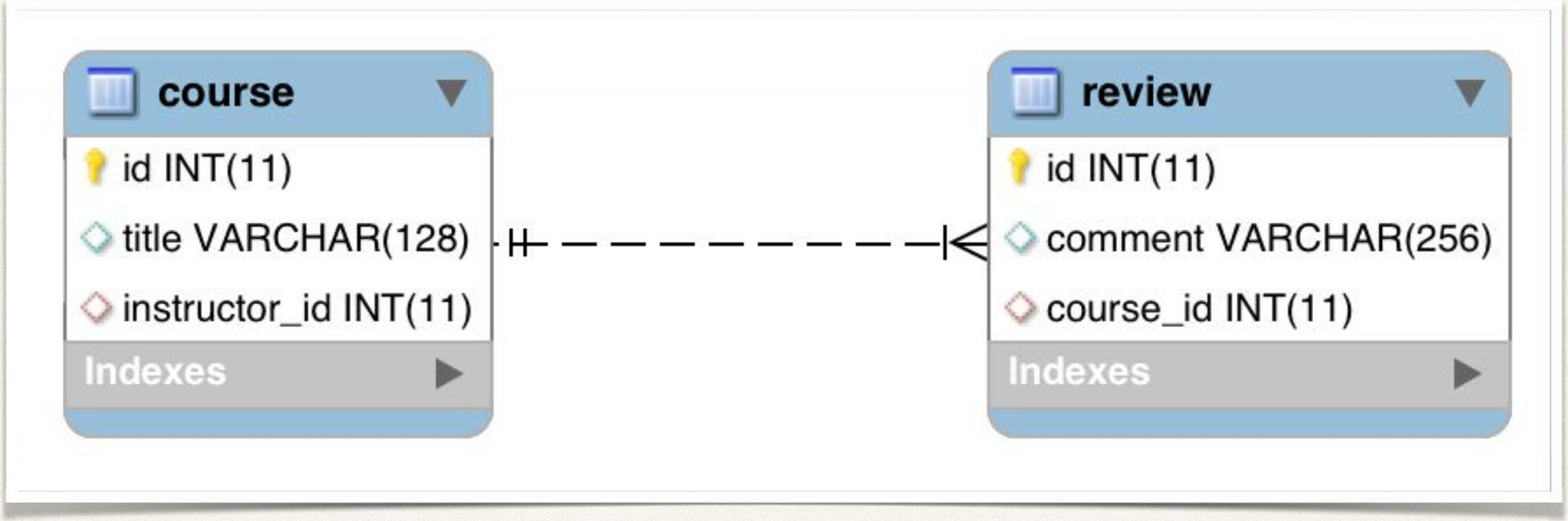
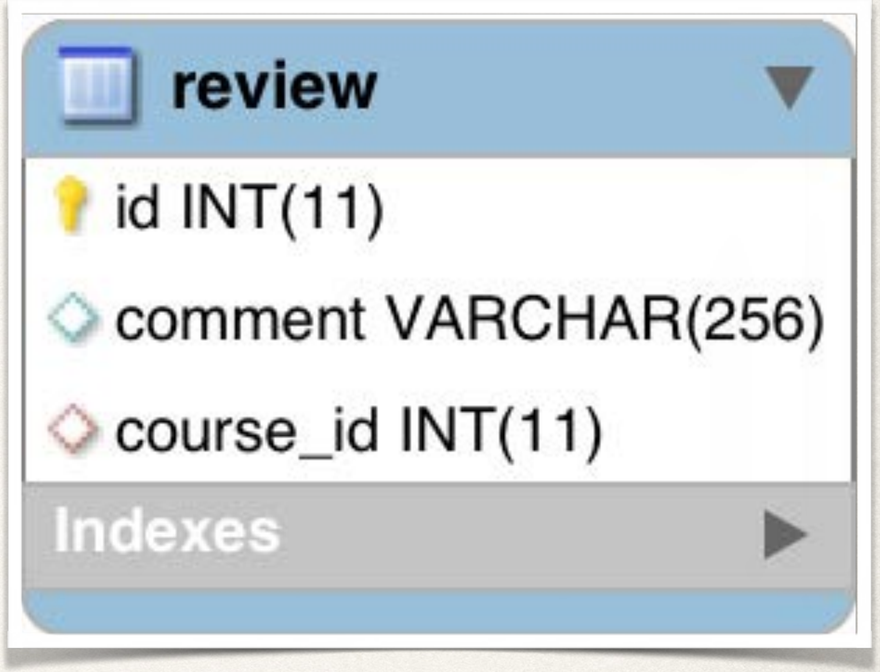


table: course - no changes



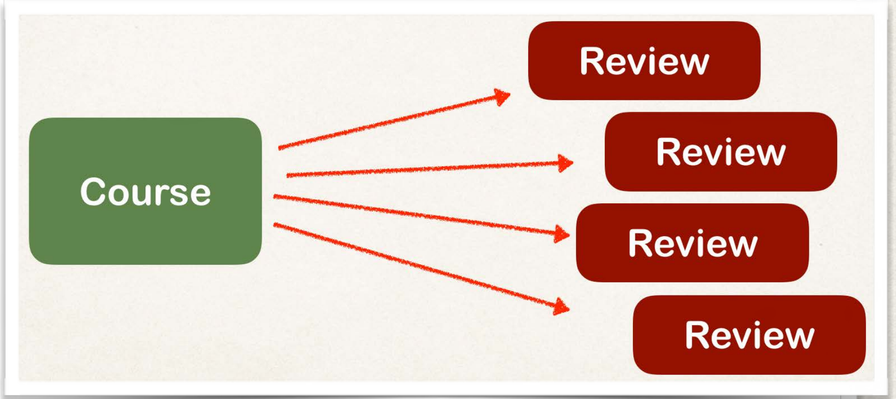
Step 2: Create Review class

```
@Entity
@Table(name="review")
public class Review {

    @Id
    @GeneratedValue(strategy=GenerationType.IDENTITY)
    @Column(name="id")
    private int id;

    @Column(name="comment")
    private String comment;

    ...
    // constructors, getters / setters
}
```



Step 3: Update Course - reference reviews

```
@Entity
@Table(name="course")
public class Course {
    ...


    private List<Review> reviews;

    // getter / setters
    ...

}
```



Add @OneToMany annotation

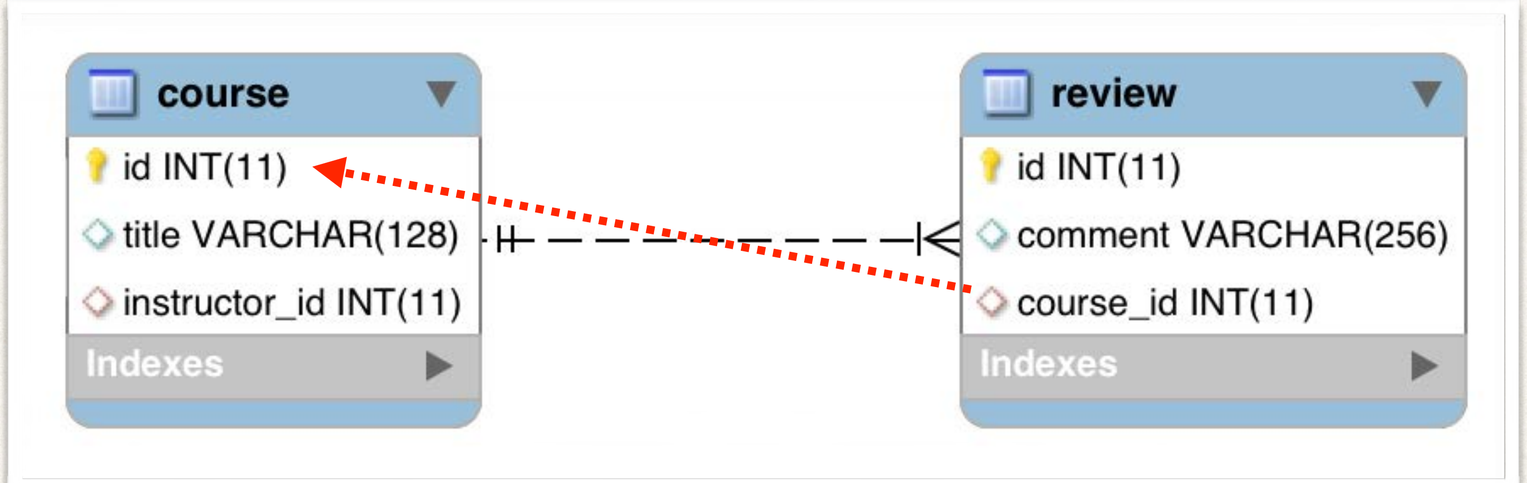
```
@Entity
@Table(name="course")
public class Course {
    ...

    @OneToMany
    @JoinColumn(name="course_id")
    private List<Review> reviews;

    // getter / setters
    ...

}
```

Refers to “course_id” column in “review” table

More: @JoinColumn

```
public class Course {
    ...

    @OneToMany
    @JoinColumn(name="course_id")
    private List<Review> reviews;
```

- In this scenario, **@JoinColumn** tells Hibernate
  - Look at the **course_id** column in the **review** table
  - Use this information to help find associated reviews for a course



Add support for Cascading

```
@Entity
@Table(name="course")
public class Course {
    ...

    @OneToMany(cascade=CascadeType.ALL)
    @JoinColumn(name="course_id")
    private List<Review> reviews;

    ...

}
```

Cascade all operations including deletes!

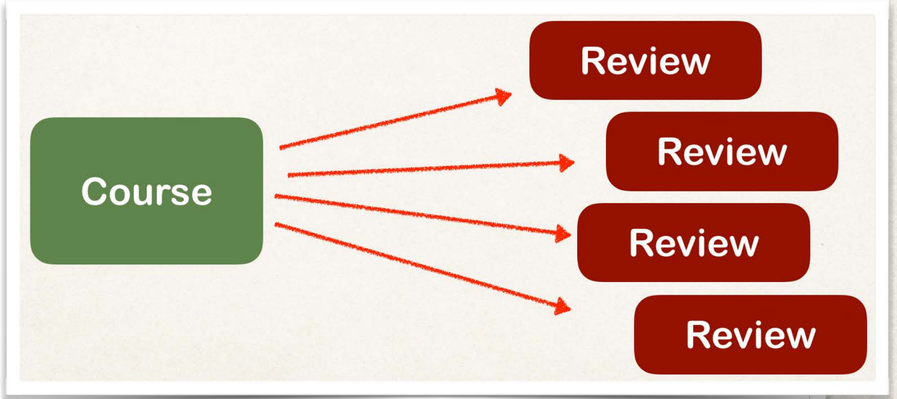
Add support for Lazy loading

```
@Entity
@Table(name="course")
public class Course {
    ...

    @OneToMany(fetch=FetchType.LAZY, cascade=CascadeType.ALL)
    @JoinColumn(name="course_id")
    private List<Review> reviews;

    ...

}
```

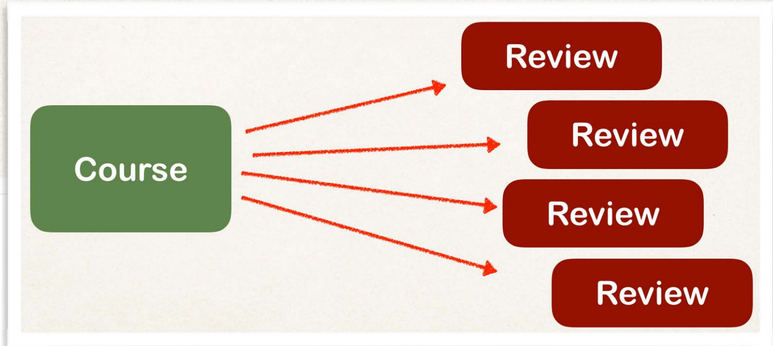
Lazy load the reviews

Add convenience method for adding review

```
@Entity
@Table(name="course")
public class Course {
   ...
   // add convenience methods for adding reviews

   public void add(Review tempReview) {

      if (reviews == null) {
         reviews = new ArrayList<>();
      }

      reviews.add(tempReview);

   }
   ...
}
```



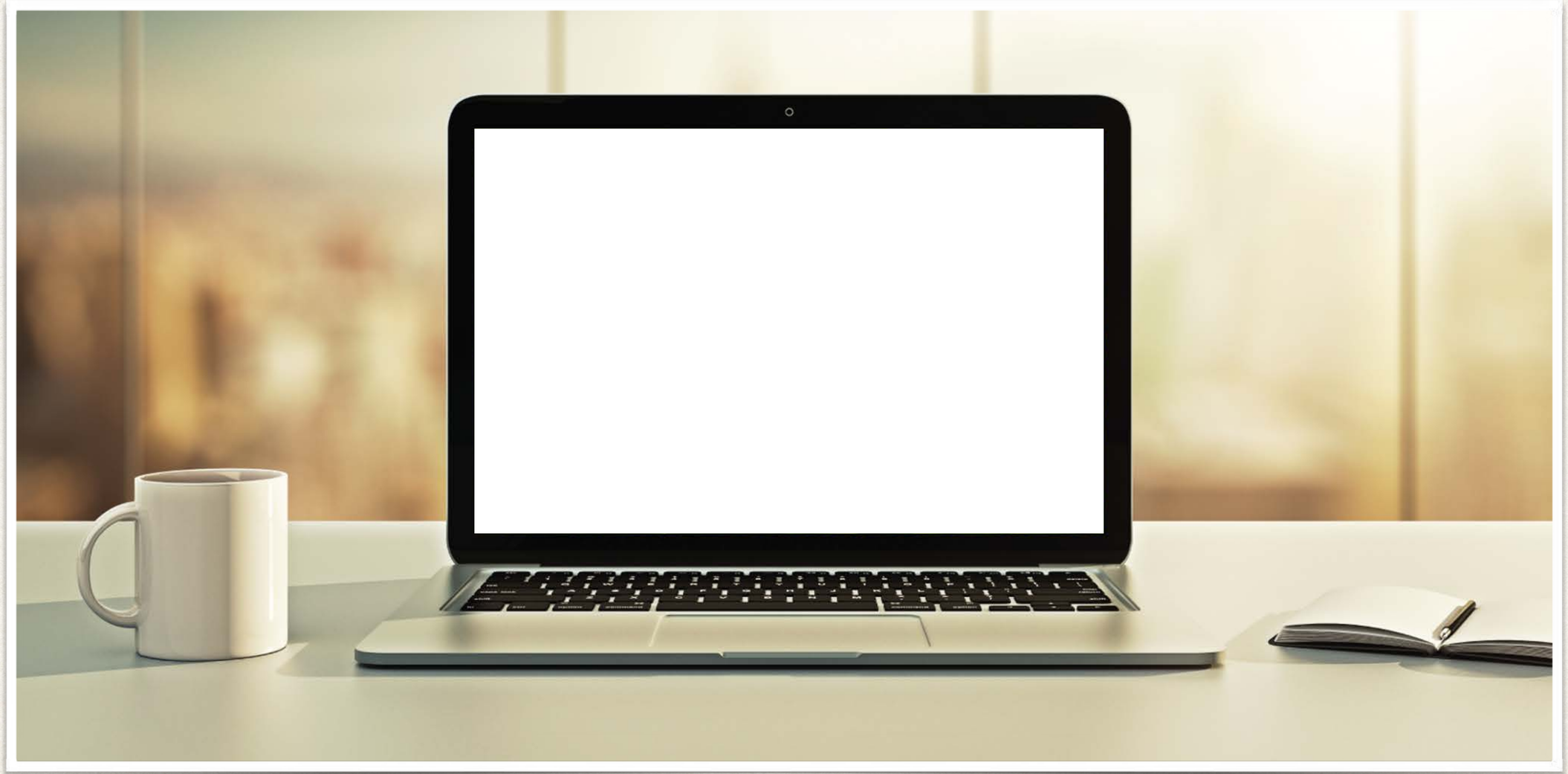
Step 4: Create Main App




```
public static void main(String[] args) {
    ...

    // get the course object
    int theId = 10;
    Course tempCourse = session.get(Course.class, theId);

    // print the course
    System.out.println("tempCourse: " + tempCourse);

    // print the associated reviews
    System.out.println("reviews: " + tempCourse.getReviews());
    ...
}
```

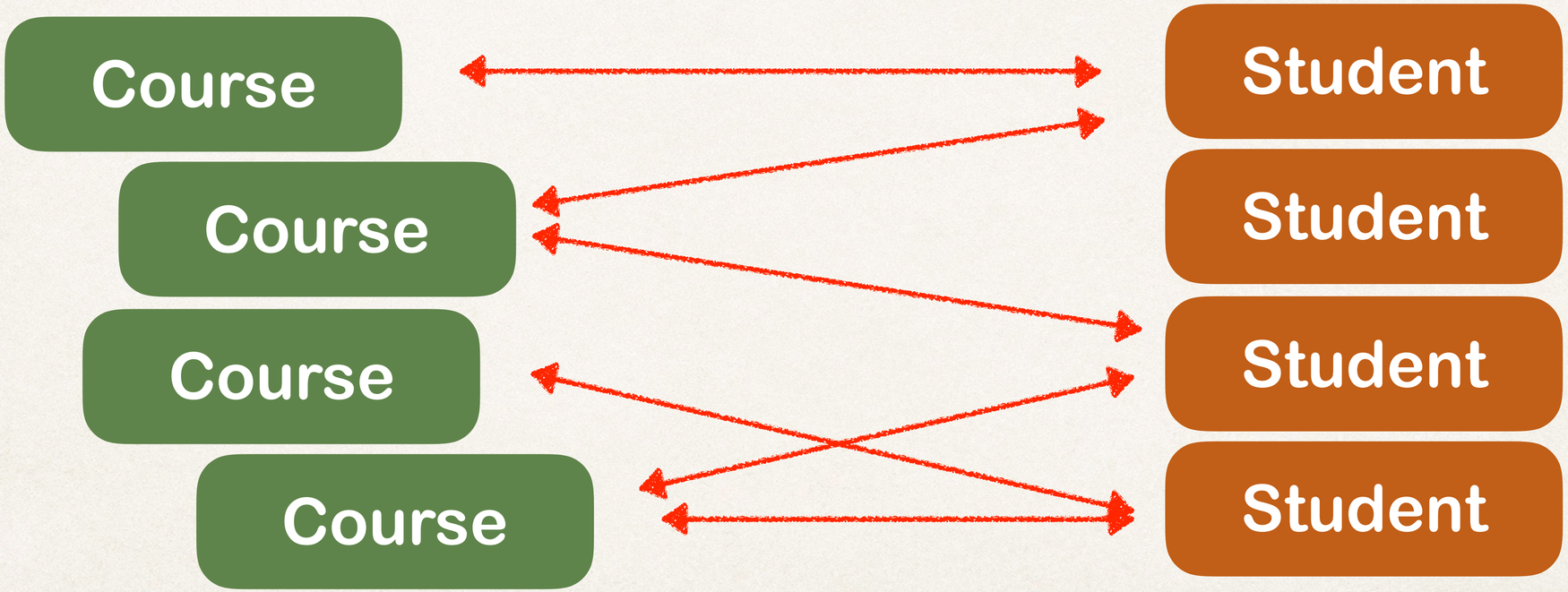
Lazy load the reviews

Hibernate Many-to-Many



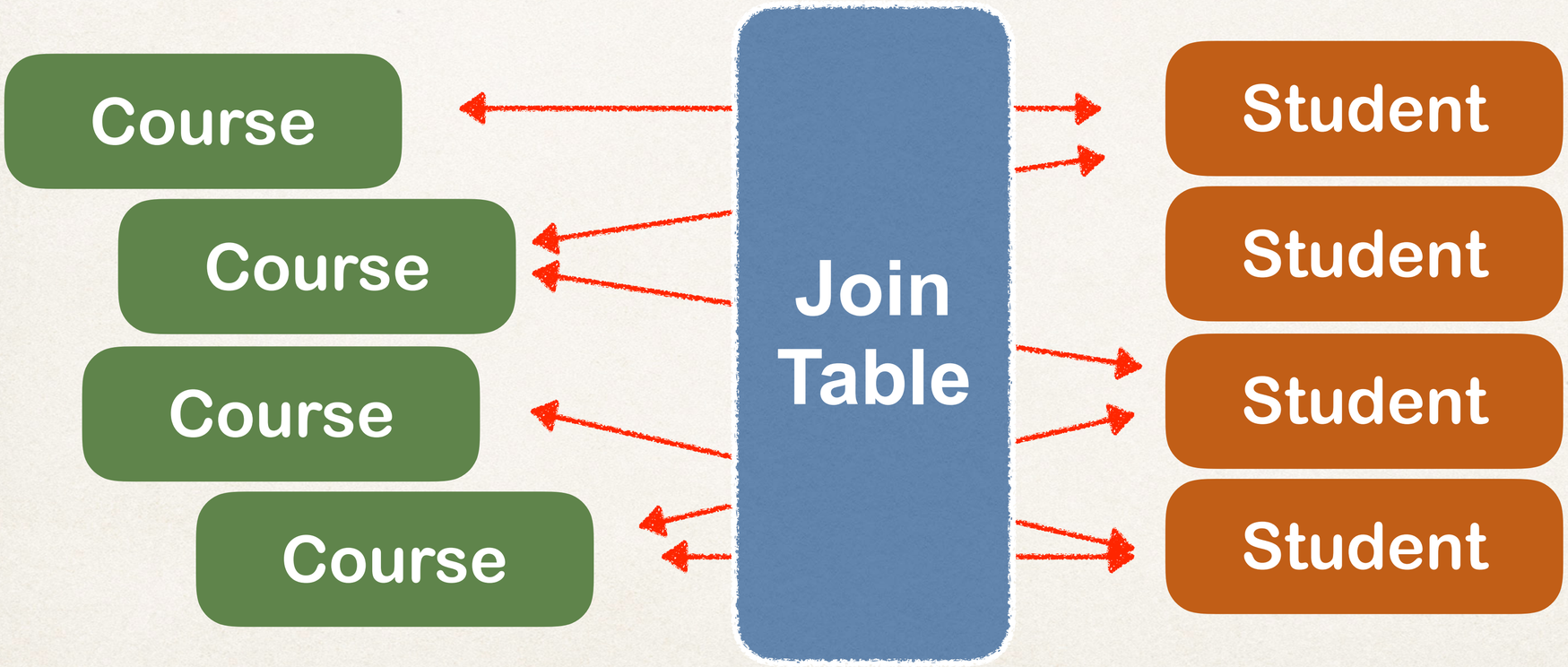
Many-to-Many Mapping

- A course can have many students
- A student can have many courses



Keep track of relationships

- Need to track which student is in which course and vice-versa

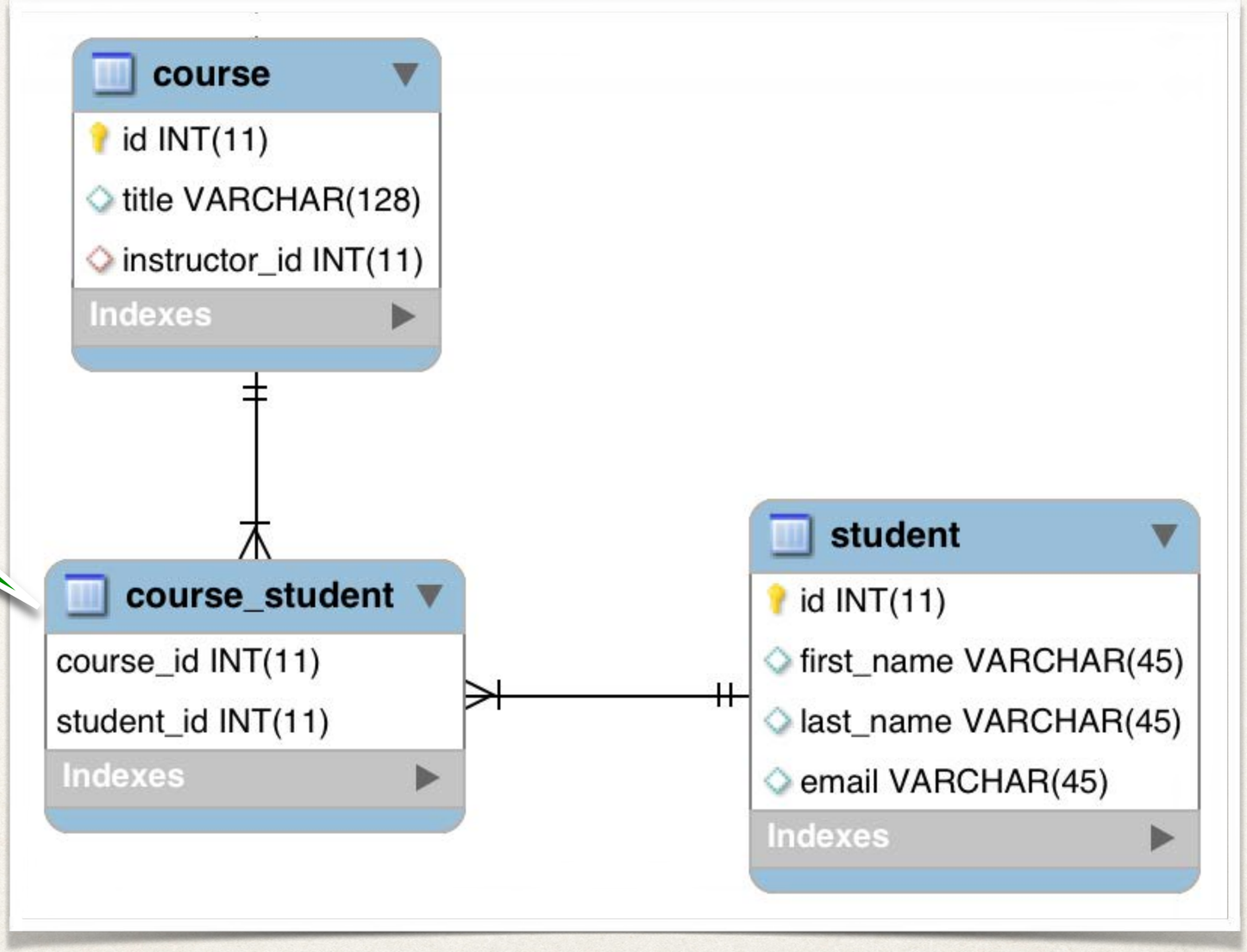


Join Table

A table that provides a mapping between two tables.

It has foreign keys for each table
to define the mapping relationship.

@ManyToMany



Join Table

Join Table Example

Find John's Courses

- Pacman

Join Table

course

id	title	instructor_id
10	Pacman - How To Score One Million Points	NULL
11	Rubik's Cube - How to Speed Cube	NULL
12	Atari 2600 - Game Development	NULL
NULL	NULL	NULL

course_student

course_id	student_id
10	1
10	2
11	2
12	2
NULL	NULL

student

id	first_name	last_name	email
1	John	Doe	john@luv2code.com
2	Mary	Public	mary@luv2code.com
NULL	NULL	NULL	NULL

Join Table Example

Find Mary's Courses

- Pacman
- Rubik's Cube
- Atari 2600

course

id	title	instructor_id
10	Pacman - How To Score One Million Points	NULL
11	Rubik's Cube - How to Speed Cube	NULL
12	Atari 2600 - Game Development	NULL
NULL		NULL

course_student

course_id	student_id
10	1
10	2
11	2
12	2
NULL	NULL

student

id	first_name	last_name	email
1	John	Doe	john@luv2code.com
2	Mary	Public	mary@luv2code.com
NULL	NULL	NULL	NULL

Development Process: Many-to-Many

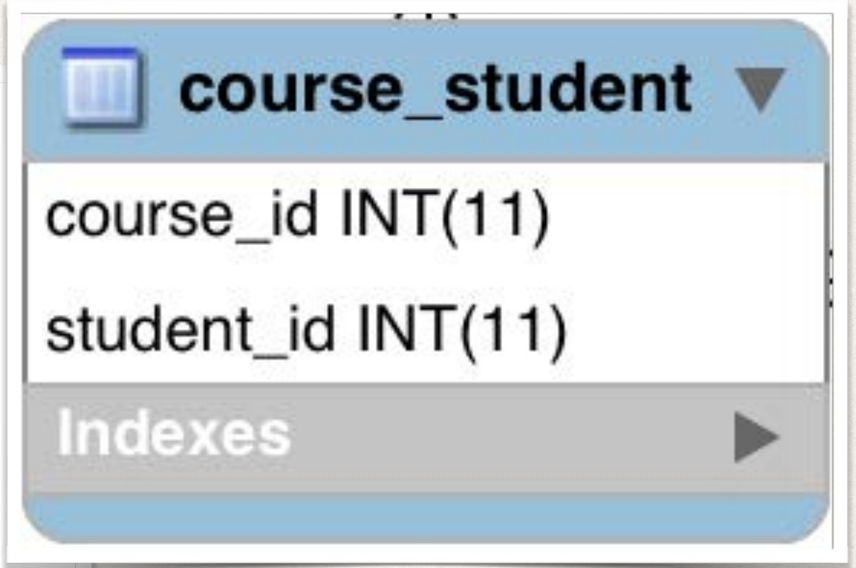
Step-By-Step

1. Prep Work - Define database tables
2. Update **Course** class
3. Update **Student** class
4. Create Main App

join table: course_student

File: create-db.sql

```
CREATE TABLE `course_student` (

  `course_id` int(11) NOT NULL,
  `student_id` int(11) NOT NULL,

  PRIMARY KEY (`course_id`, `student_id`),

   ...
);
```



join table: course_student - foreign keys

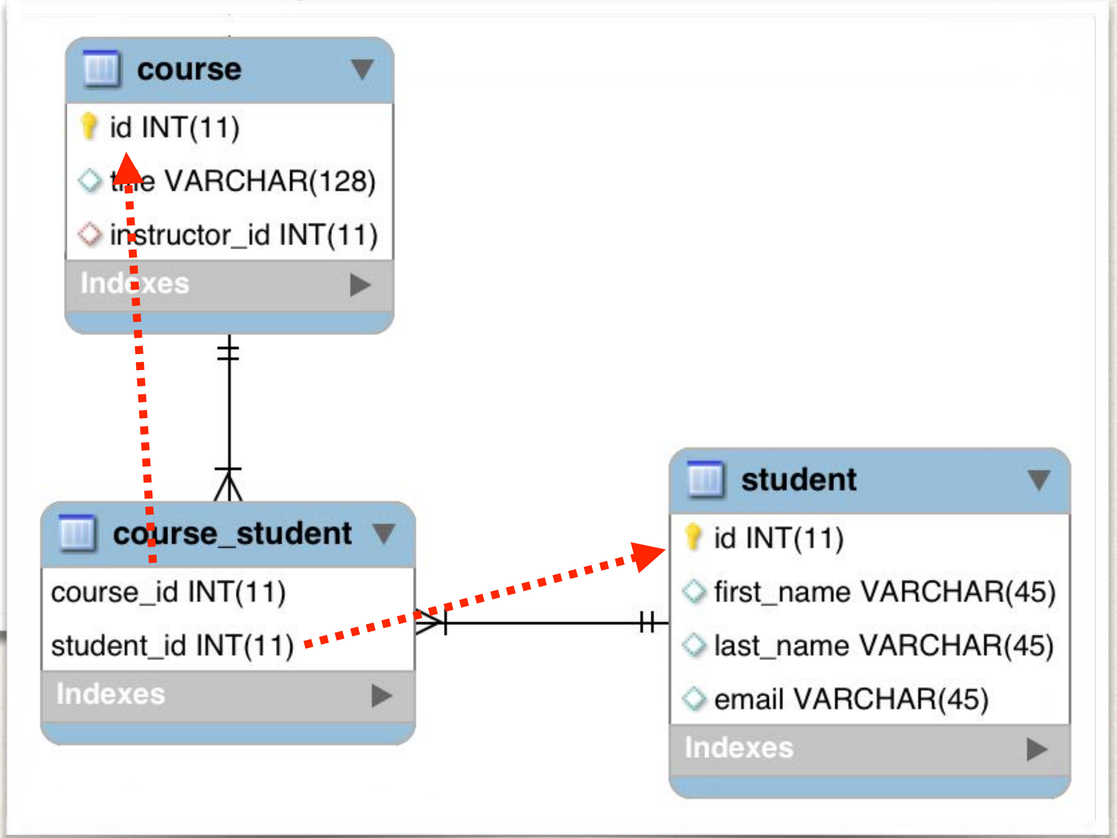
```
CREATE TABLE `course_student` (
  …
  CONSTRAINT `FK_COURSE_05`
  FOREIGN KEY (`course_id`)
  REFERENCES `course` (`id`),

  CONSTRAINT `FK_STUDENT
  FORE (`student_i
  REFER `student` (
  …
);
```

Table

Column

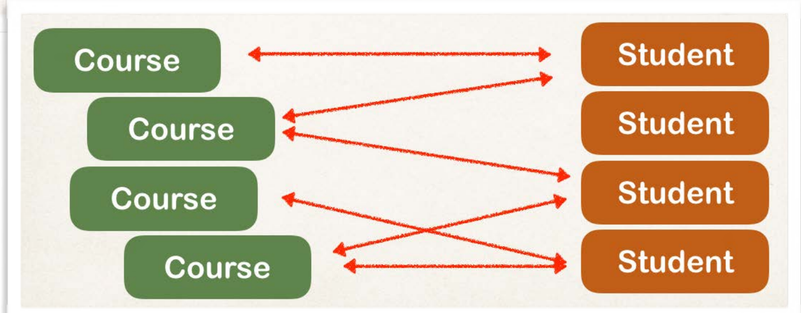
Table

Column



Step 2: Update Course - reference students

```
@Entity
@Table(name="course")
public class Course {
    ...


    private List<Student> students;

    // getter / setters
    ...

}
```

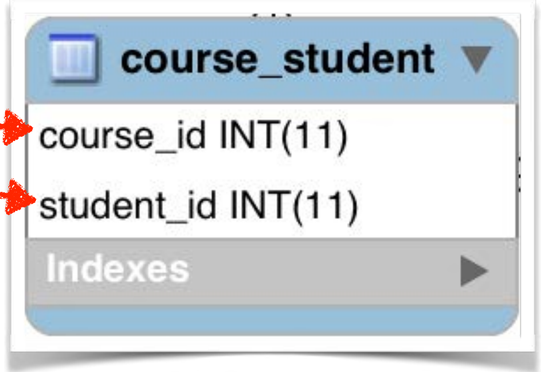


Add @ManyToMany annotation

```
@Entity
@Table(name="course")
public class Course {
   ...

   @ManyToMany
   @JoinTable(
         name="course_student",
         joinColumns=@JoinColumn(name="course_id"),
         inverseJoinColumns=@JoinColumn(name="student_id")
         )
   private List<Student> students;

   // getter / setters
   ...

}
```

Refers to
in “course

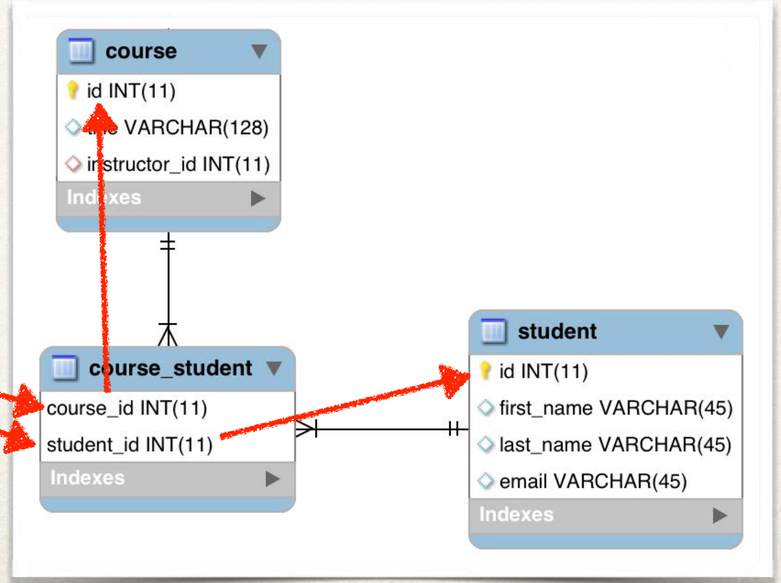
Refers to “student_id” column
in “course_student” join table



More: @JoinTable

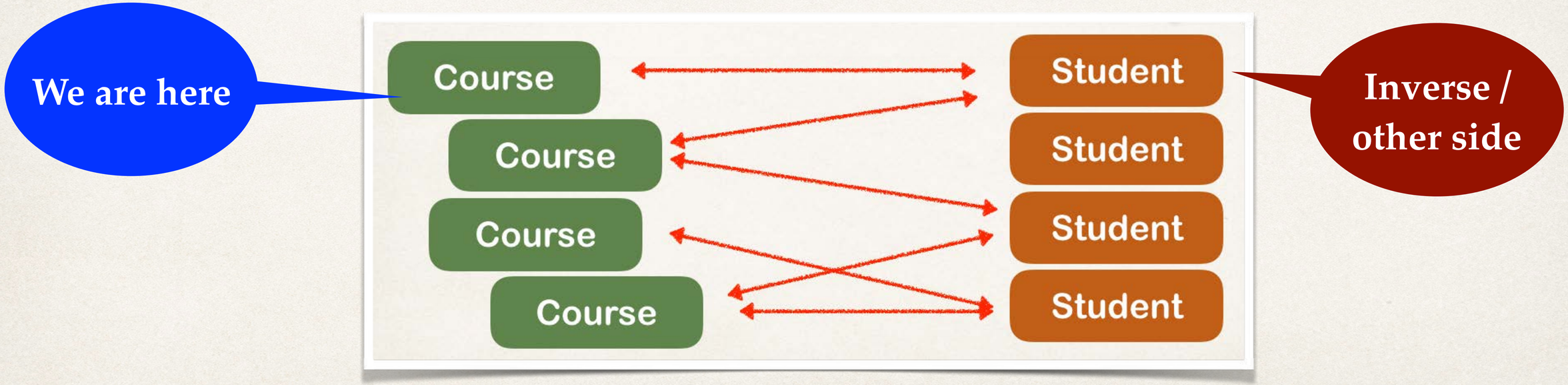
- **@JoinTable** tells Hibernate
  - Look at the **course_id** column in the **course_student** table
  - For other side (inverse), look at the **student_id** column in the **course_student** table
  - Use this information to find relationship between **course** and **students**

```
public class Course {

    @ManyToMany
    @JoinTable(
            name="course_student",
            joinColumns=@JoinColumn(name="course_id"),
            inverseJoinColumns=@JoinColumn(name="student_id")
            )
    private List<Student> students;

}
```



More on "inverse"

- In this context, we are defining the relationship in the **Course** class
- The **Student** class is on the "other side" … so it is considered the "inverse"
- "Inverse" refers to the "other side" of the relationship

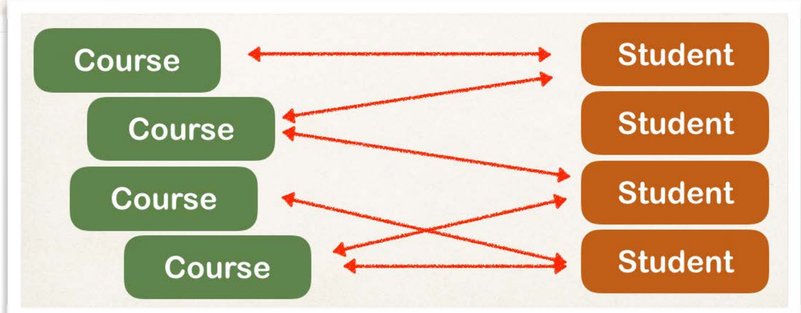


Now, let’s do a similar thing for Student

just going the other way …

Step 3: Update Student - reference courses

```
@Entity
@Table(name="student")
public class Student {
    ...



    private List<Course> courses;

    // getter / setters
    ...

}
```

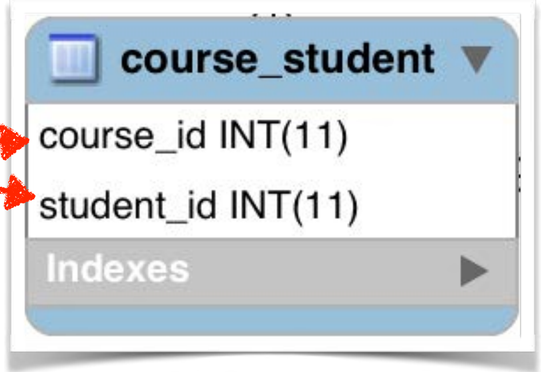


Add @ManyToMany annotation

```
@Entity
@Table(name="student")
public class Student {
   ...

   @ManyToMany
   @JoinTable(
         name="course_student",
         joinColumns=@JoinColumn(name="student_id"),
         inverseJoinColumns=@JoinColumn(name="course_id")
         )
   private List<Course> courses;

   // getter / setters
   ...

}
```

Refers to “student_id” column in “course_student” join table

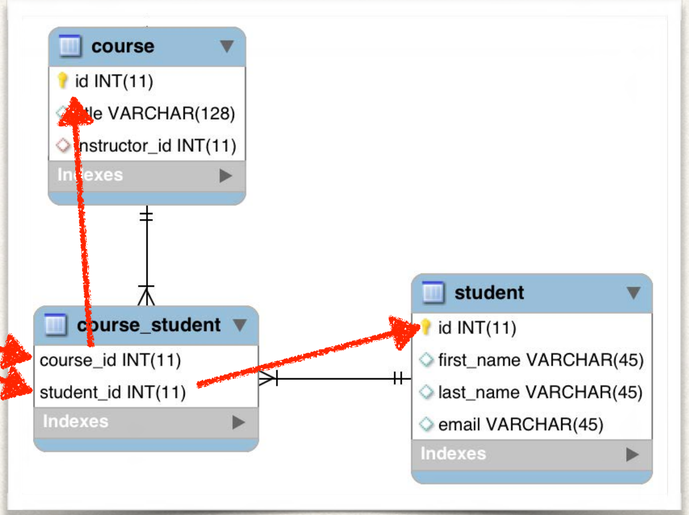
umn
in “course_student” join table



More: @JoinTable

- **@JoinTable** tells Hibernate
  - Look at the **student_id** column in the **course_student** table
  - For other side (inverse), look at the **course_id** column in the **course_student** table
  - Use this information to find relationship between **student** and **courses**

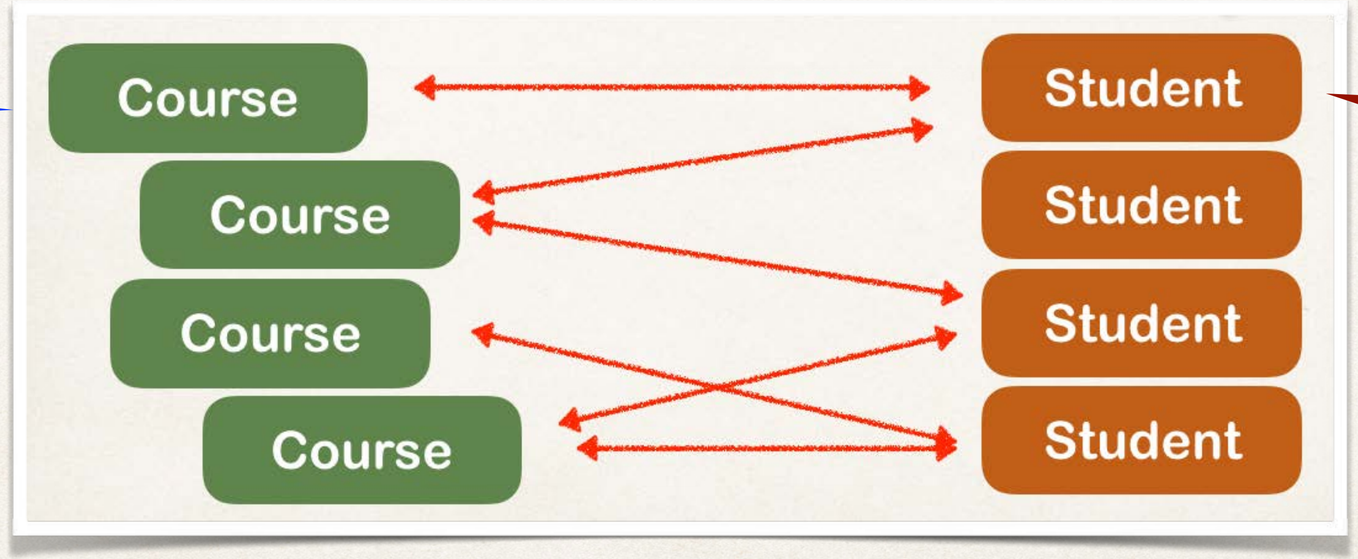
```
public class Student {

    @ManyToMany
    @JoinTable(
            name="course_student",
            joinColumns=@JoinColumn(name="student_id"),
            inverseJoinColumns=@JoinColumn(name="course_id")
            )
    private List<Course> courses;

}
```



More on "inverse"

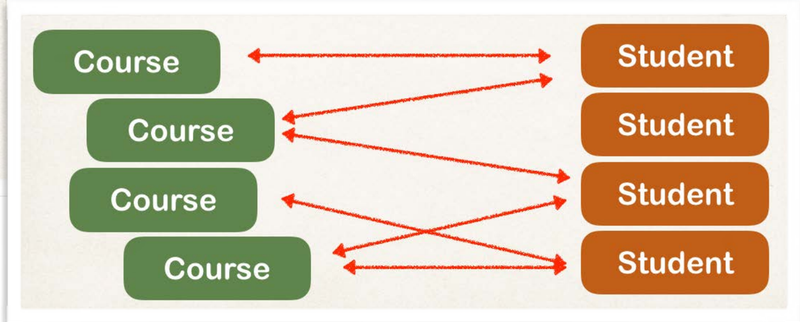
- In this context, we are defining the relationship in the **Student** class
- The **Course** class is on the "other side" … so it is considered the "inverse"
- "Inverse" refers to the "other side" of the relationship

Inverse / other side



We are here

Step 4: Create Main App

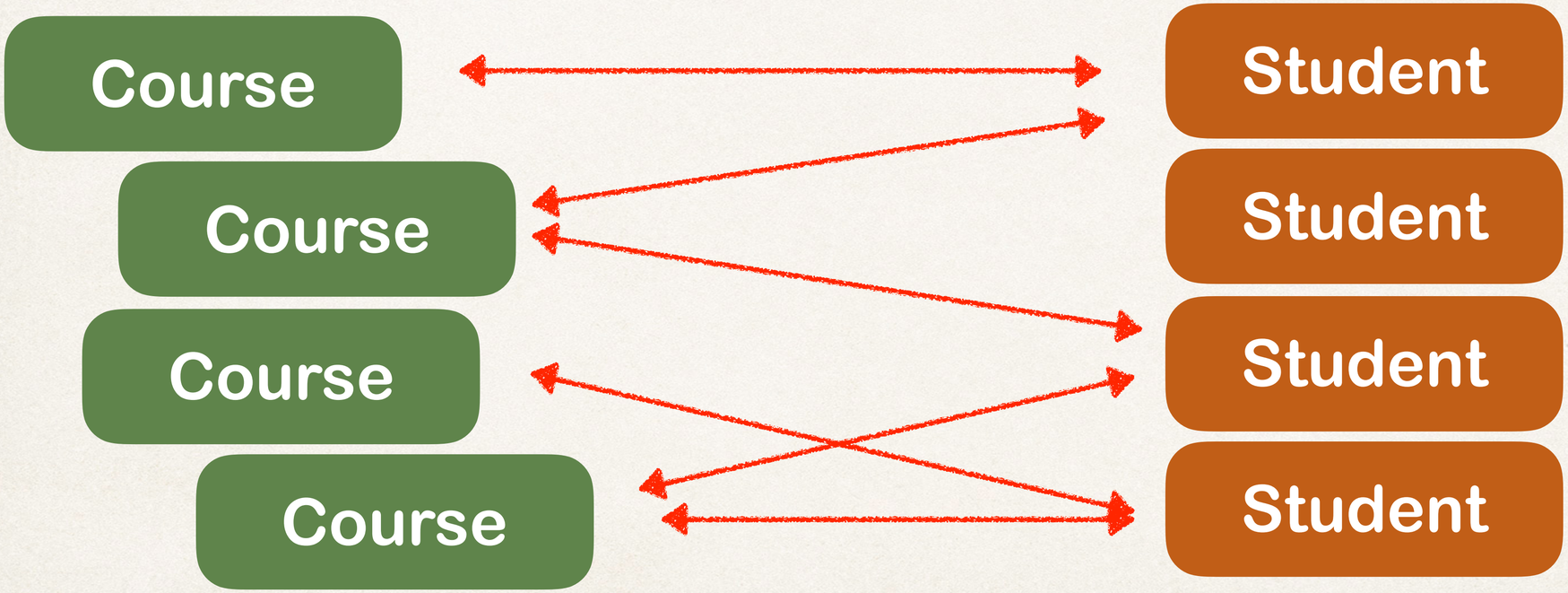



```
public static void main(String[] args) {
        ...

        // get the course object
        int theId = 10;
        Course tempCourse = session.get(Course.class, theId);

        // print the course
        System.out.println("tempCourse: " + tempCourse);

        // print the associated students
        System.out.println("students: " + tempCourse.getStudents());
        ...
}
```

Real-World Project Requirement

- If you delete a course, DO NOT delete the students

DO NOT apply cascading deletes!



Other features

- In the next set of videos, we'll add support for other features
- **Lazy Loading** of students and courses
- **Cascading** to handle cascading saves … but NOT deletes
  - If we delete a course, DO NOT delete students
  - If we delete a student, DO NOT delete courses