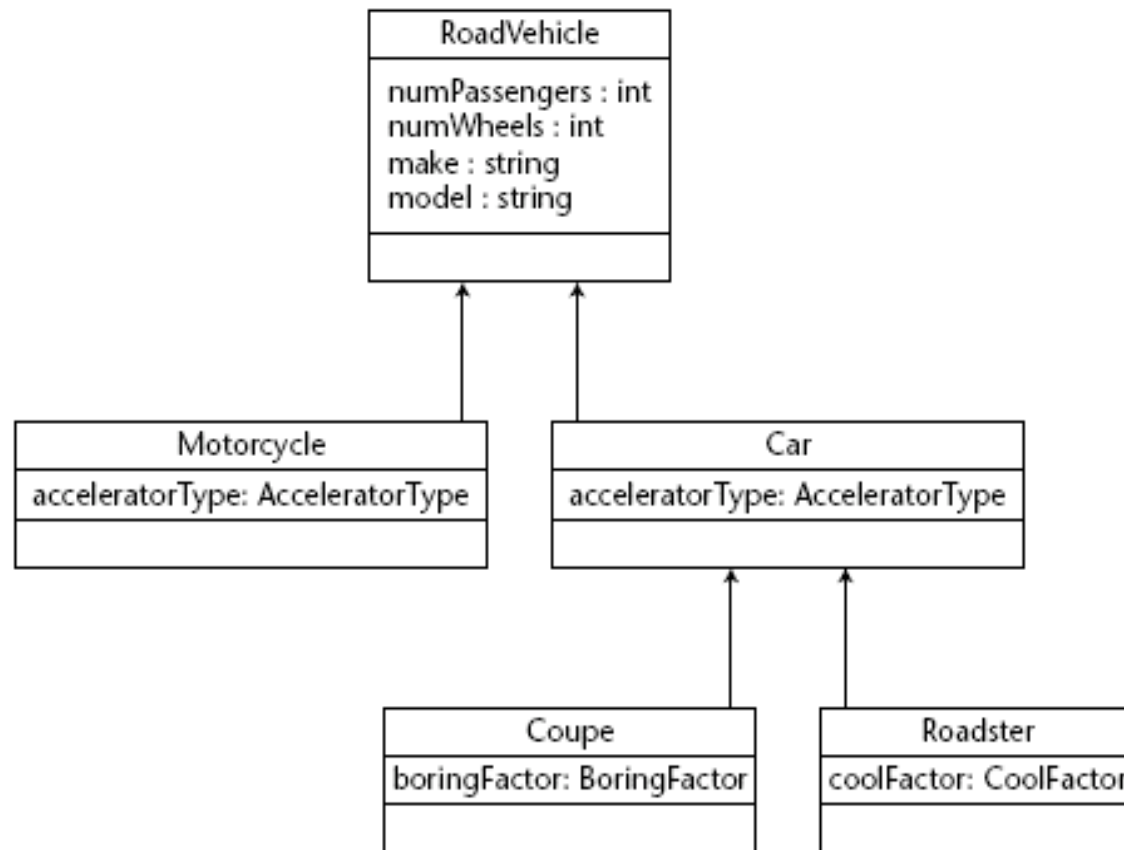


Advanced Persistency

Inheritance

Mapping inheritance



SINGLE TABLE PER CLASS

Id	numPass	numWheels	make	model
1	6	2	HORSE CART	NULL

Id	numPass	numWheels	make	model	acceleratorType
2	1	2	HONDA	HRC7	THROTTLE

etc.

**Problems with polymorphism – how do you find
“all RoadVehicles that have less than 3 passenger?”**

SINGLE TABLE PER CLASS HIERARCHY

Id	numPass	numWheels	make	model	DISC	accelerartortype	Boring Factor	CoolFactor
1	6	2	HORSE CAR T	NULL	ROAD VEHI CLE	NULL	NULL	NULL
2	1	2	HOND A	HRC7	MOTO RCYC LE	THROTTLE	NULL	NULL
3	4	4	FIAT	PUNTO	CAR	PEDAL	NULL	NULL
4	2	4	FERR ARI	F70	COUP E	PEDAL	1	NULL
5	2	4	FORD	KA	ROAD STER	PEDAL	NULL	1

- Space inefficiency
- Impossible to set “NON-NULL” constraints on fields of the subclasses.

JOINED TABLES

RoadVehicle

Id	DTYPE	numPas s	numWheel s	make	model
1	ROADVEHICLE	6	2	HORSECART	NULL
2	MOTORCYCLE	1	2	HONDA	HRC7
3	CAR	4	4	FIAT	PUNTO
4	COUPE	2	4	FERRARI	F70
5	ROADSTER	2	4	FORD	KA

Car

Id	acceleratoretype
3	PEDAL
4	PEDAL
5	PEDAL

Coupe

Id	boringFactor
4	1

Many joins in a deep inheritance hierarchy – time inefficiency.

The base class

```
package examples.entity.single_table;
// imports go here
@Entity(name="RoadVehicleSingle")
@Table(name="ROADVEHICLE") //optional, it's the default
@Inheritance(strategy=InheritanceType.SINGLE_TABLE)
@DiscriminatorColumn(name="DISC",
    discriminatorType=DiscriminatorType.STRING)
@DiscriminatorValue("ROADVEHICLE")
// @Inheritance(strategy=InheritanceType.JOINED)
public class RoadVehicle implements Serializable {
    public enum AcceleratorType {PEDAL,THROTTLE};
    @Id
    protected int id;
    protected int numPassengers;
    protected int numWheels;
    protected String make;
    protected String model;
    public RoadVehicle() {
        id = (int) System.nanoTime();
    }
    // setters and getters go here
    ...
}
```

The derived class

```
package examples.entity.single_table;
// imports go here
@Entity
@DiscriminatorValue("MOTORCYCLE") //not needed for joined
public class Motorcycle extends RoadVehicle implements
    Serializable {
    public final AcceleratorType acceleratorType
        =AcceleratorType.THROTTLE;
    public Motorcycle() {
        super();
        numWheels = 2;
        numPassengers = 2;
    }
}
```

Advanced Persistency

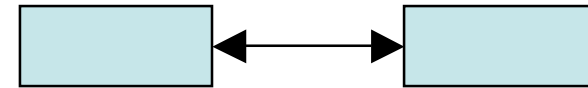
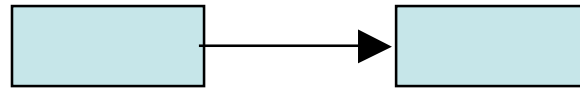
Relationships

Multiplicity and Directionality – 7 types

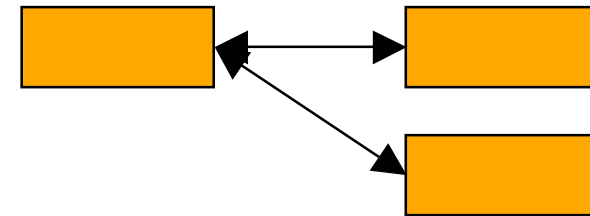
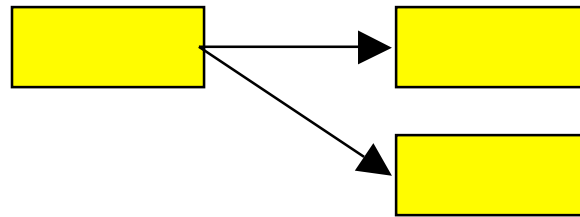
Unidirectional

Bidirectional

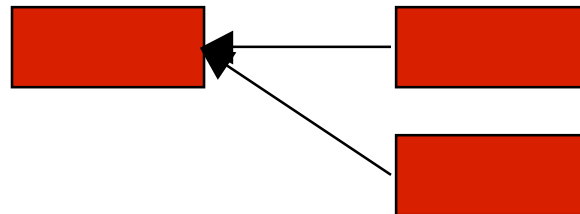
1:1



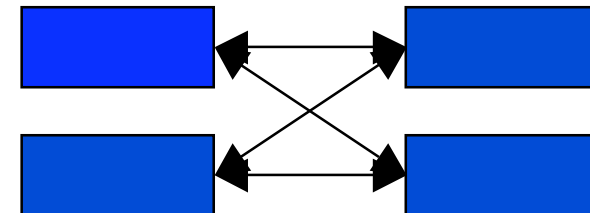
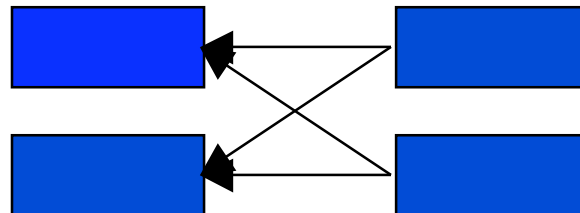
1:N



N:1

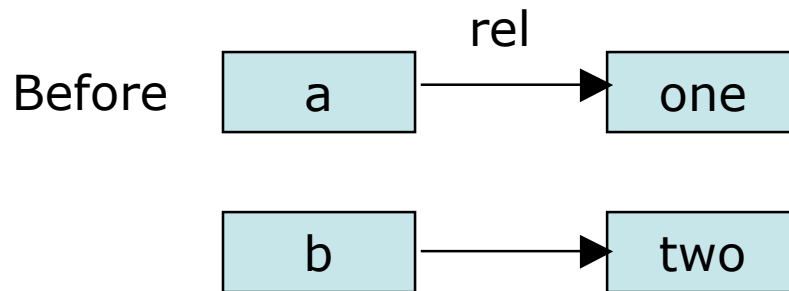


N:M

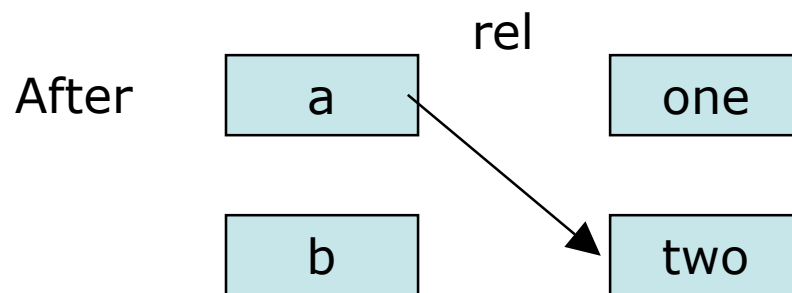


Watch out for side effects!

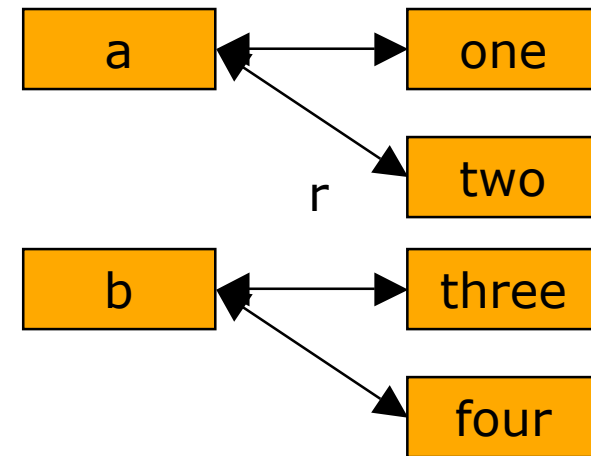
Let rel be a 1:1 relationship



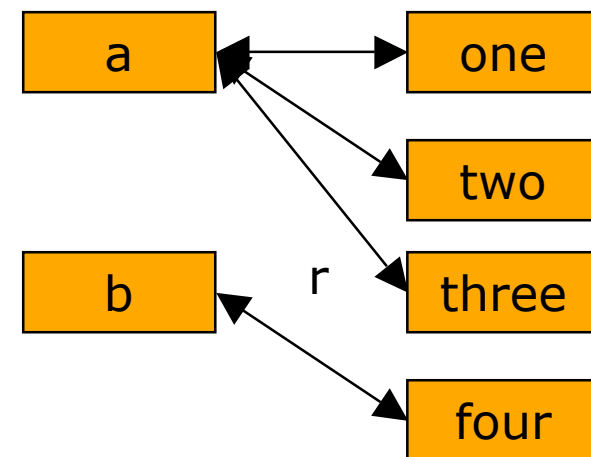
`a.setRel(two)`



Let r be a 1:N relationship

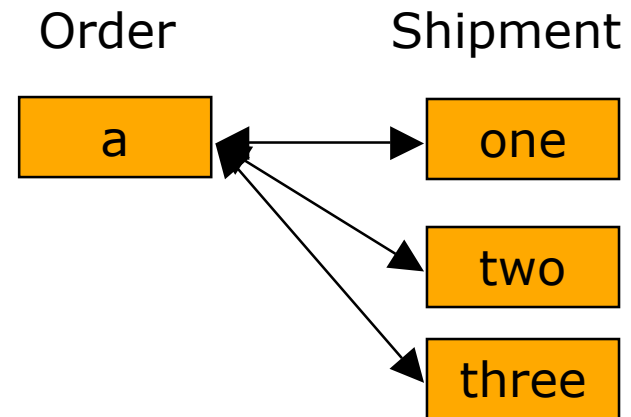


`a.setR(three)`



Cascade-delete

When we delete "a",
should also one,two e three
be canceled?



Relation – 1:1 unidir – “from”

```
@Entity(name="OrderUni")
public class Order implements Serializable {
    private int id;
    private String orderName;
    private Shipment shipment;
    public Order() { id = (int)System.nanoTime(); }
    @Id
    public int getId() { return id; }
    public void setId(int id) {
        this.id = id;
    }
    ...
    // other setters and getters go here
    ...
    @OneToOne(cascade={CascadeType.PERSIST})
    public Shipment getShipment() {
        return shipment;
    }
    public void setShipment(Shipment shipment) {
        this.shipment = shipment;
    }
}
```

Relation – 1:1 unidir – “to”

```
...
@Entity(name="ShipmentUni")
public class Shipment implements Serializable {
    private int id;
    private String city;
    private String zipcode;
    public Shipment() { id = (int)System.nanoTime(); }
    @Id
    public int getId() { return id; }
    public void setId(int id) { this.id = id; }
    ...
    // other setters and getters go here
}
```

Relation – 1:1 unidir – client

```
...
@Stateless
public class OrderShipmentUniBean implements OrderShipment {
    @PersistenceContext
    EntityManager em;
    public void doSomeStuff() {
        Shipment s = new Shipment();
        s.setCity("Austin");
        s.setZipcode("78727");
        Order o = new Order();
        o.setOrderName("Software Order");
        o.setShipment(s);
        em.persist(o);
    }
    public List getOrders() {
        Query q = em.createQuery("SELECT o FROM OrderUni o");
        return q.getResultList();
    }
}
```

Relation – 1:1 bidir – “to”

```
...
@Entity(name="ShipmentUni")
public class Shipment implements Serializable {
    private int id;
    private String city;
    private String zipcode;
    private Order order;
    public Shipment() { id = (int)System.nanoTime(); }
    @Id
    public int getId() { return id; }
    public void setId(int id) { this.id = id; }
    ...
    // other setters and getters go here
    ...
    @OneToOne(mappedBy="shipment")
    // shipmentproperty from the Order entity
    public Order getOrder() {
        return order;
    }
    public void setOrder(Order order) {
        this.order = order;
    }
}
```

Relation – 1:1 bidir – client

...

@Stateless

```
public class OrderShipmentUniBean implements OrderShipment {
    @PersistenceContext
    EntityManager em;
    public void doSomeStuff() {
        Shipment s = new Shipment();
        s.setCity("Austin");
        s.setZipcode("78727");
        Order o = new Order();
        o.setOrderName("Software Order");
        o.setShipment(s);
        em.persist(o);
    }
    public List getOrders() {
        Query q = em.createQuery("SELECT o FROM OrderUni o");
        return q.getResultList();
    }
    ..
    public List getShipments() {
        Query q = em.createQuery("SELECT s FROM Shipment s");
        return q.getResultList();
    }
}
```

Relation – 1:N unidir – “from”

```
...
@Entity(name="CompanyOMUni")
public class Company implements Serializable {
    private int id;
    private String name;
    private Collection<Employee> employees;
    ...
    // other getters and setters go here
    // including the Id
    ...
    @OneToMany(cascade={CascadeType.ALL}, fetch=FetchType.EAGER)
        public Collection<Employee> getEmployees() {
            return employees;
        }
    public void setEmployees(Collection<Employee> employees) {
        this.employees = employees;
    }
}
```

Relation – 1:N unidir – “to”

```
...
@Entity(name="EmployeeOMUni")
public class Employee implements Serializable {
    private int id;
    private String name;
    private char sex;
    ...
    // other getters and setters go here
    // including the Id
    ...
}
```

Relation – 1:N unidir – client

```
Company c = new Company();
c.setName("M*Power Internet Services, Inc."); Collection<Employee>
    employees = new ArrayList<Employee>();
Employee e = new Employee();
e.setName("Micah Silverman"); e.setSex('M'); employees.add(e);
e = new Employee();
e.setName("Tes Silverman"); e.setSex('F'); employees.add(e);
c.setEmployees(employees);
em.persist(c);

c = new Company();
c.setName("Sun Microsystems");
employees = new ArrayList<Employee>();
e = new Employee();
e.setName("Rima Patel"); e.setSex('F'); employees.add(e);
e = new Employee();
e.setName("James Gosling"); e.setSex('M'); employees.add(e);
c.setEmployees(employees);
em.persist(c);
```

Relation – 1:N bidir – “from”

```
...
@Entity(name="CompanyOMUni")
public class Company implements Serializable {
    private int id;
    private String name;
    private Collection<Employee> employees;
    ...
    // other getters and setters go here
    // including the Id
    ...
    @OneToMany(cascade={CascadeType.ALL}, fetch=FetchType.EAGER,
mappedBy="company")
        public Collection<Employee> getEmployees() {
            return employees;
        }
    public void setEmployees(Collection<Employee> employees) {
        this.employees = employees;
    }
}
```

Relation – 1:N bidir – “to”

```
...
@Entity(name="EmployeeOMUni")
public class Employee implements Serializable {
    private int id;
    private String name;
    private char sex;
    private Company company;
    ...
    // other getters and setters go here
    // including the Id
    @ManyToOne
    public Company getCompany() {
        return company;
    }
    public void setCompany(Company company) {
        this.company = company;
    }
}
```

Relation – M:N

The rules for generating a join table are:

1. The name of the join table will be the **name of the owning entity**, followed by an underscore (**_**), followed by the **name of the target entity**.
2. The name of the first column in the join table will be the **property name**, followed by an **underscore**, followed by the **primary key name** in the owner entity.
3. The name of the second column in the join table will be the **property name**, followed by an **underscore**, followed by the **primary key name** in the target entity.
4. The types of the columns in the join table will match the primary key types of the tables that will be referenced by it.

Relation – M:N unidir – “from”

```
...
@Entity(name="StudentUni")
public class Student implements Serializable {
    private int id;
    private String name;
    private Collection<Course> courses = new ArrayList<Course>();
    public Student() { id = (int)System.nanoTime(); }
    @Id
    public int getId() { return id; }
    ...
    //other setters and getters go here
    ...
    @ManyToMany(cascade={CascadeType.ALL}, fetch=FetchType.EAGER)
    @JoinTable(name="STUDENTUNI_COURSEUNI")
    public Collection<Course> getCourses() {
        return courses;
    }
    public void setCourses(Collection<Course> courses) {
        this.courses = courses;
    }
}
```

Relation – M:N unidir – “to”

```
...
@Entity(name="CourseUni")
public class Course implements Serializable {
    private int id;
    private String courseName;
    private Collection<Student> students = new ArrayList<Student>();
    ...
    //setters and getters go here
    ...
}
```

Relation – M:N bidir – “from”

```
...
@Entity(name="StudentUni")
public class Student implements Serializable {
    private int id;
    private String name;
    private Collection<Course> courses = new ArrayList<Course>();
    public Student() { id = (int)System.nanoTime(); }
    @Id
    public int getId() { return id; }
    ...
    //other setters and getters go here
    ...
    @ManyToMany(cascade={CascadeType.ALL}, fetch=FetchType.EAGER)
    @JoinTable(name="STUDENTUNI_COURSEUNI")
    public Collection<Course> getCourses() {
        return courses;
    }
    public void setCourses(Collection<Course> courses) {
        this.courses = courses;
    }
}
```

Relation – M:N bidir – “to”

```
...
@Entity(name="CourseBid")
public class Course implements Serializable {
    private int id;
    private String courseName;
    private Collection<Student> students = new ArrayList<Student>();
    ...
    //getters and setters go here
    ...
    @ManyToMany(cascade={CascadeType.ALL},
        fetch=FetchType.EAGER,mappedBy="courses")
        public Collection<Student> getStudents() {
            return students;
        }
    public void setStudents(Collection<Student> students) {
        this.students = students;
    }
}
```