

Design Patterns

MSc Computer Science

Produced
by

Eamonn de Leastar (edeleastar@wit.ie)

Department of Computing, Maths & Physics
Waterford Institute of Technology

<http://www.wit.ie>

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Data Source

Data Source

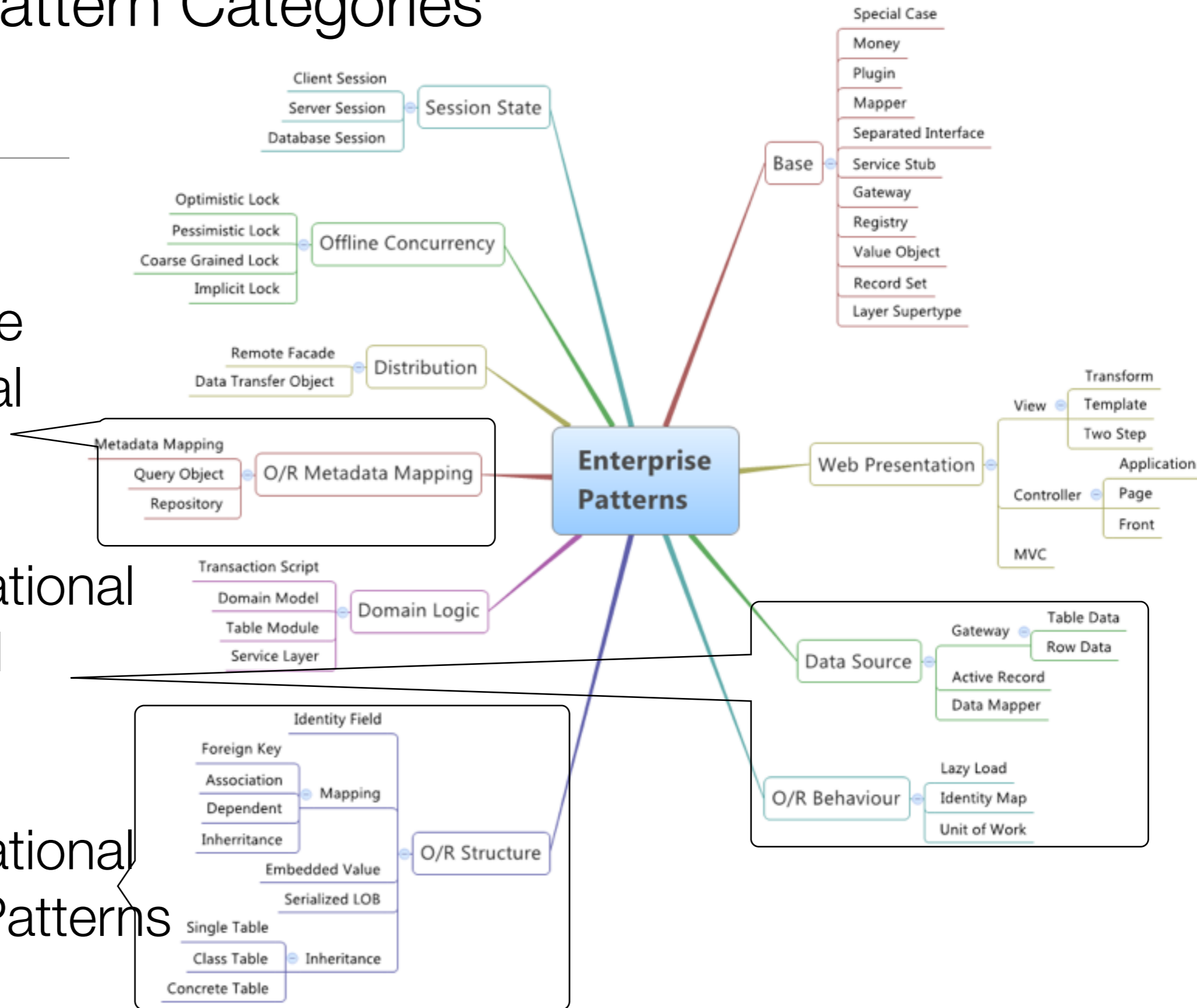
- Communicating with other systems that carry out tasks on behalf of the application.
- These can be transaction monitors, other applications, messaging systems, etc...
- For most enterprise applications this is a database that is primarily responsible for storing persistent data.

Database Pattern Categories

- Data Source Architectural Patterns

- Object-Relational Behavioural Patterns

- Object-Relational Structural Patterns

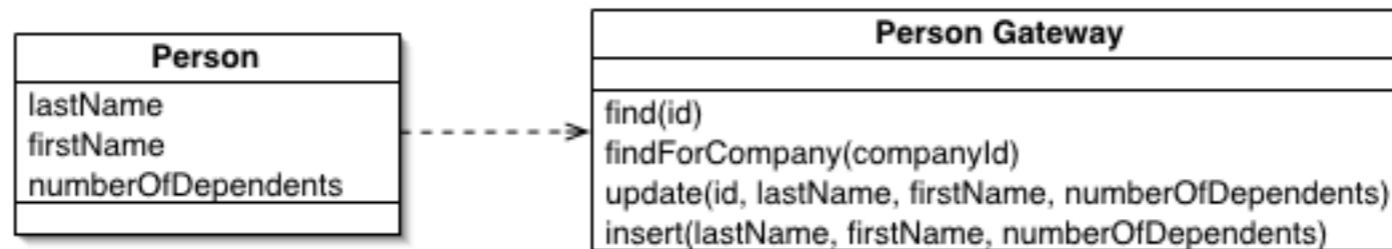


Data Source Architectural Patterns

- Drive the way in which the domain logic talks to the database.
- The choice made are far-reaching for the design and thus difficult to refactor
- Patterns
 - **Table Data Gateway**
 - **Active Record**
 - Row Data Gateway
 - Data Mapper

Table Data Gateway

An object that acts as a Gateway to a database table. One instance handles all the rows in the table.

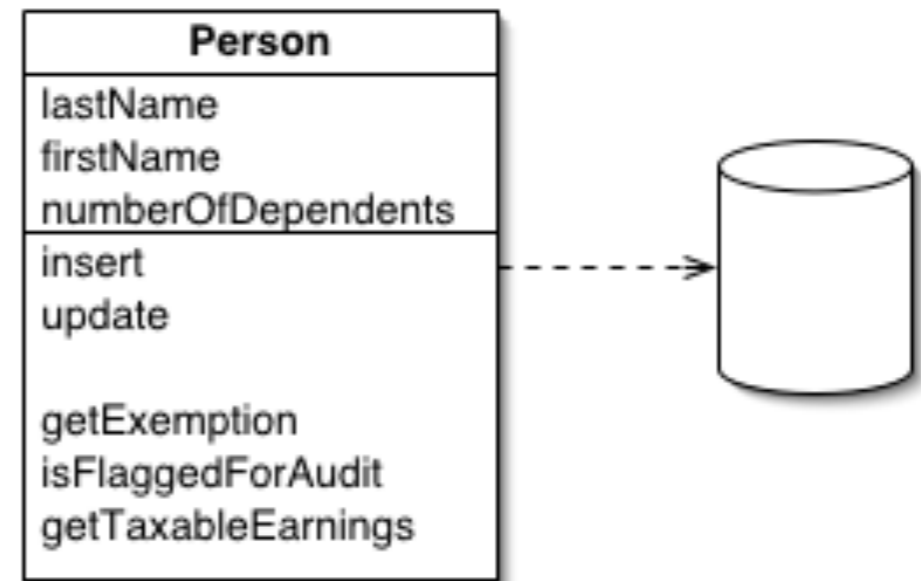


- Mixing SQL in application logic can cause several problems:
 - Many developers aren't comfortable with SQL, and many who are comfortable may not write it well.
 - Database administrators need to be able to find SQL easily so they can figure out how to tune and evolve the database.
- A Table Data Gateway holds all the SQL for accessing a single table or view: selects, inserts, updates, and deletes.
- Other code calls its methods for all interaction with the database.

Active Record

An object that wraps a row in a database table or view, encapsulates the database access, and adds domain logic on that data

- An object carries both data and behavior.
- Much of this data is persistent and needs to be stored in a database.
- Active Record uses the most obvious approach, putting data access logic in the domain object.
- This way all people know how to read and write their data to and from the database.



Data Source Architectural Patterns in Pacemaker Play

Active Record

- Static methods encapsulate all access to User table

```
public class User extends Model
{
    @Id
    @GeneratedValue
    public Long id;
    public String firstname;
    public String lastname;
    public String email;
    public String password;

    @OneToMany(cascade=CascadeType.ALL)
    public List<Activity> activities = new ArrayList<Activity>();

    //...

    public static User findByEmail(String email)
    {
        return User.find.where().eq("email", email).findUnique();
    }

    public static User findById(Long id)
    {
        return find.where().eq("id", id).findUnique();
    }

    public static List<User> findAll()
    {
        return find.all();
    }

    public static void deleteAll()
    {
        for (User user: User.findAll())
        {
            user.delete();
        }
    }

    public static Model.Finder<String, User>
        find = new Model.Finder<String, User>(String.class, User.class);
}
```

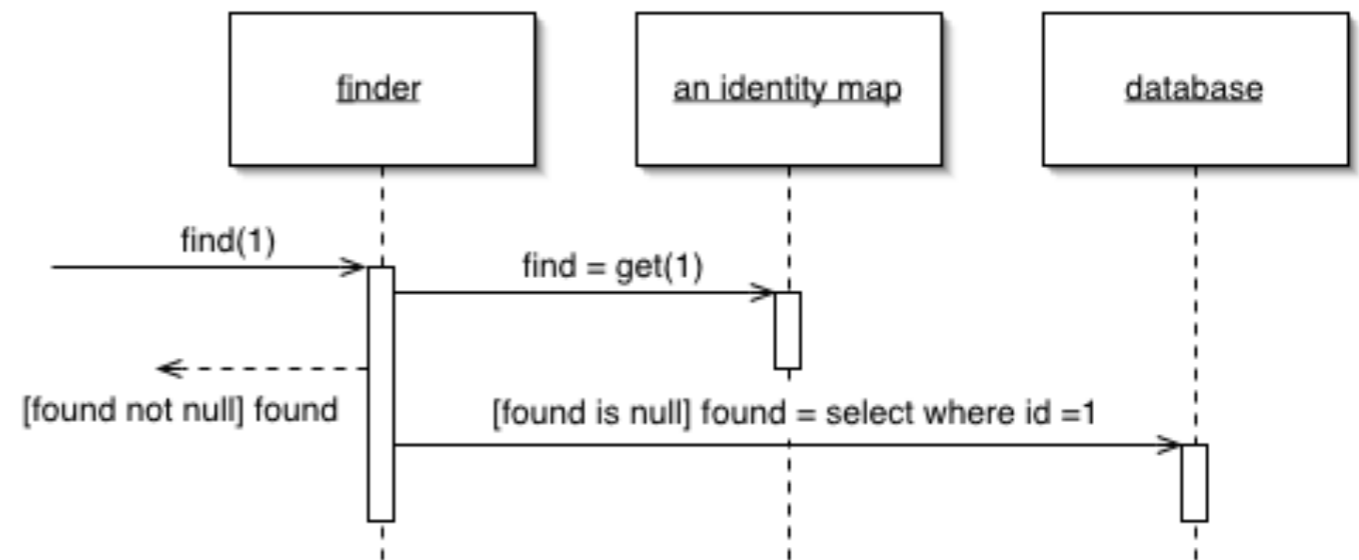

Object-Relational Behavioural Patterns

- How to get the various objects to load and save themselves to the databases you read objects and modify them, you have to ensure that the database state you're working with stays consistent.
- If you read some objects, it's important to ensure that the reading is isolated so that no other process changes any of the objects you've read while you're working on them.
- Otherwise, you could have inconsistent and invalid data in your objects.
- Patterns
 - **Identity Map**
 - **Unit of Work**
 - **Lazy Load**

Identity Map

Ensures that each object gets loaded only once by keeping every loaded object in a map. Looks up objects using the map when referring to them.

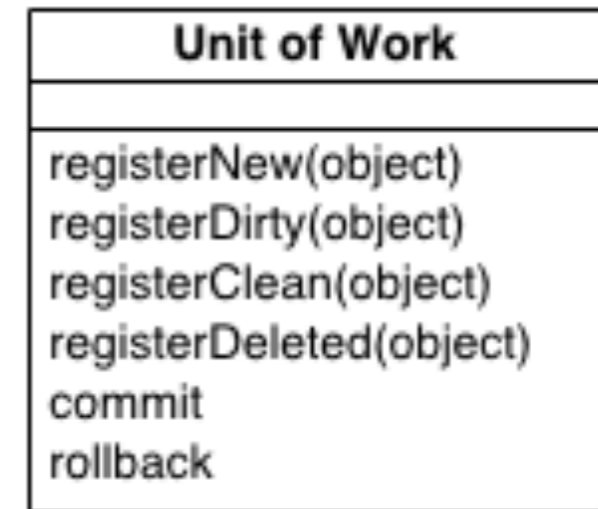
- An Identity Map keeps a record of all objects that have been read from the database in a single business transaction.
- Whenever you want an object, you check the Identity Map first to see if you already have it.
- Avoids problem whereby data from the same database record into two different objects
- Also, may improve efficiency



Unit of Work

Maintains a list of objects affected by a business transaction and coordinates the writing out of changes and the resolution of concurrency problems.

- If you change the database with each change to your object model this can lead to lots of very small database calls
- Furthermore it requires you to have a transaction open for the whole interaction, which is impractical if you have a business transaction that spans multiple requests.
- A Unit of Work keeps track of everything you do during a business transaction that can affect the database, and resolve all outstanding changes when the task is concluded.



Lazy Load

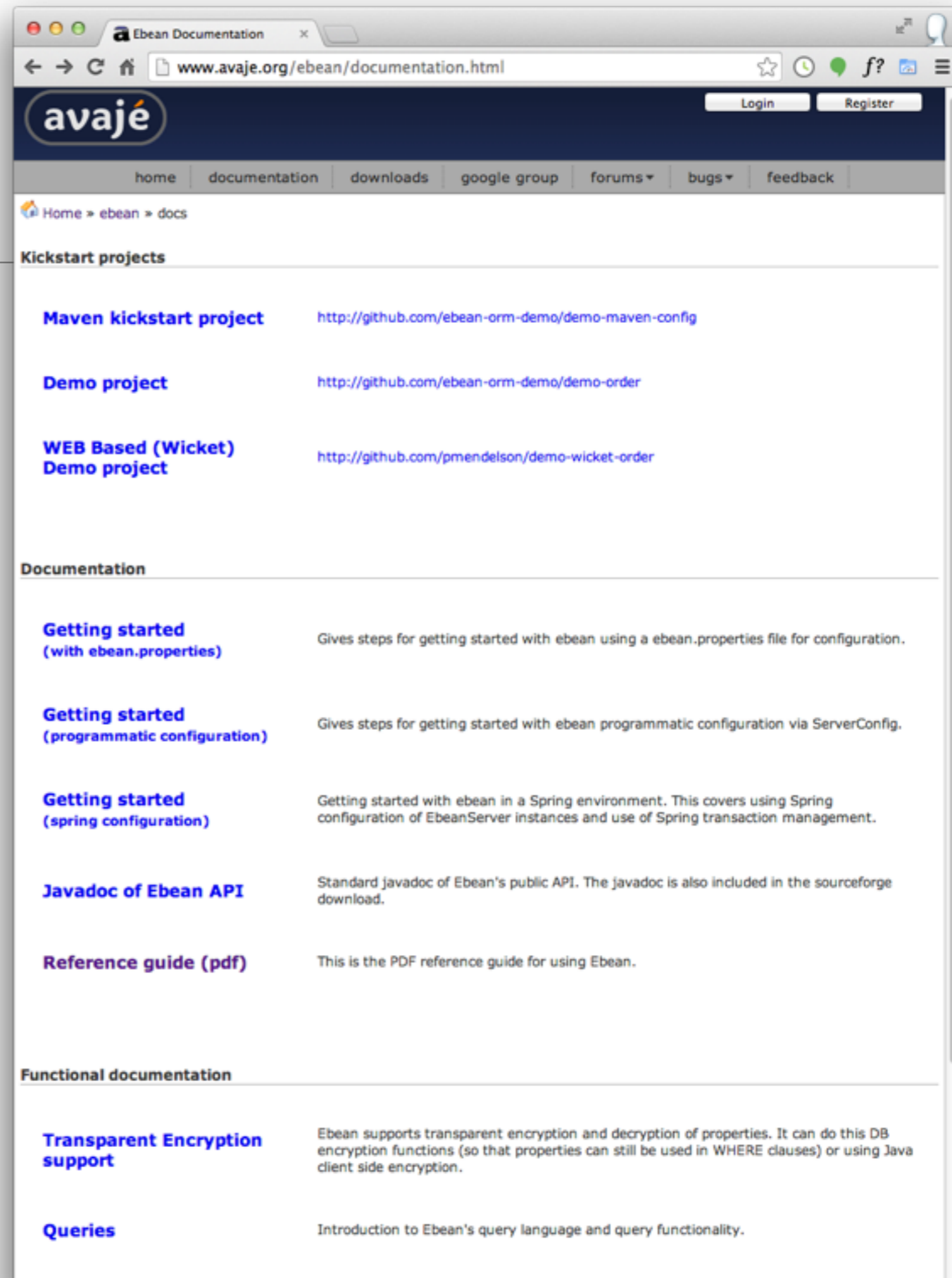
An object that doesn't contain all of the data you need but knows how to get it.

- For loading data from a database into memory it's convenient to load the objects that are related to the object of interest.
- However, if you take this to its logical conclusion, you reach the point where loading one object can have the effect of loading a huge number of related objects.
- A Lazy Load interrupts this loading process, leaving a marker in the object structure so that if the data is needed it can be loaded only when it is used

Unit of Work
registerNew(object)
registerDirty(object)
registerClean(object)
registerDeleted(object)
commit
rollback

Object-Relational Behavioural Patterns in Pacemaker Play

- pacemaker-play uses ebean JPA provider
- Which implements a full ranager of Behavioural patterns



The screenshot shows the Avaje Ebean Documentation website. The browser address bar displays www.avaje.org/ebean/documentation.html. The website features a dark blue header with the Avaje logo and navigation links for home, documentation, downloads, google group, forums, bugs, and feedback. Below the header, there are buttons for Login and Register. The main content area is divided into sections: Kickstart projects, Documentation, and Functional documentation. The Kickstart projects section lists three projects with their respective GitHub URLs. The Documentation section lists five items: Getting started (with ebean.properties), Getting started (programmatic configuration), Getting started (spring configuration), Javadoc of Ebean API, and Reference guide (pdf). The Functional documentation section lists two items: Transparent Encryption support and Queries.

Section	Item	Description
Kickstart projects	Maven kickstart project	http://github.com/ebean-orm-demo/demo-maven-config
	Demo project	http://github.com/ebean-orm-demo/demo-order
	WEB Based (Wicket) Demo project	http://github.com/pmendelson/demo-wicket-order
Documentation	Getting started (with ebean.properties)	Gives steps for getting started with ebean using a ebean.properties file for configuration.
	Getting started (programmatic configuration)	Gives steps for getting started with ebean programmatic configuration via ServerConfig.
	Getting started (spring configuration)	Getting started with ebean in a Spring environment. This covers using Spring configuration of EbeanServer instances and use of Spring transaction management.
	Javadoc of Ebean API	Standard javadoc of Ebean's public API. The javadoc is also included in the sourceforge download.
	Reference guide (pdf)	This is the PDF reference guide for using Ebean.
Functional documentation	Transparent Encryption support	Ebean supports transparent encryption and decryption of properties. It can do this DB encryption functions (so that properties can still be used in WHERE clauses) or using Java client side encryption.
	Queries	Introduction to Ebean's query language and query functionality.

Object-Relational Structural Patterns

- Primarily concerned with the way objects and relations handle links
- Two main problems:
 - Objects handle links by storing references that are held by the runtime of either memory-managed environments or memory addresses. Relational databases handle links by forming a key into another table.
 - Objects can easily use collections to handle multiple references from a single field, while normalization forces all relation links to be single valued. This leads to reversals of the data structure between objects and tables.
- An order object naturally has a collection of line item objects that don't need any reference back to the order. However, the table structure is the other way around—the line item must include a foreign key reference to the order since the order can't have a multivalued field.

Object-Relational Structural Patterns

- Identity Field
- Foreign Key Mapping
- Association Table Mapping
- Dependent Mapping
- Embedded Value
- Serialized LOB
- Single Table Inheritance
- Class Table Inheritance
- Concrete Table Inheritance
- Inheritance Mappers
- Most of these patterns have been absorbed into Object Relational Mapping frameworks
- This include 4 mapping annotations:
 - OneToMany
 - ManyToOne
 - OneToOne
 - ManyToMany
- + a range of other annotations to support sophisticated mapping schemes

Major Object-
Relational
Structural
Patterns
specified by
JPA 2 and
implemented
by bean

The screenshot shows a web browser window displaying the page for JSR-000317 Java Persistence 2.0 (Final Release) on the Java Community Process website. The browser's address bar shows the URL: <https://jcp.org/aboutjava/communityprocess/final/jsr317/>. The page features the Java logo and the text "Java Community Process" and "Community Development of Java Technology Specifications".

JSRs

Search

- > JSRs by Platform
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JSR-000317 Java™ Persistence 2.0 (Final Release)

This is the Final Release of this Specification, as described in Section 3.5 of the Java Community ProcessSM Program, version 2.7.

Specification:

- To view the specification for evaluation, click here: [DOWNLOAD](#)
- To download the specification for building an implementation, click here: [DOWNLOAD](#)

Maintenance Lead:

- Linda DeMichiel
Sun Microsystems, Inc.

Please send comments via the [jsr-317-public discussion board](#).

Reference Implementation and Technology Compatibility Kit:

- <http://www.eclipse.org/eclipselink/downloads/ri.php>
- The TCK is available to Java EE platform licensees through the Java Partner Engineering web site: <http://www.sun.com/software/jpe/>

The TCK will be available to Qualified Not-for-Profits and Qualified Individuals for no charge as per Section F.III of the JSPA 2. Details on the Compatibility Testing Scholarship Program can be found at <http://java.sun.com/scholarship/>

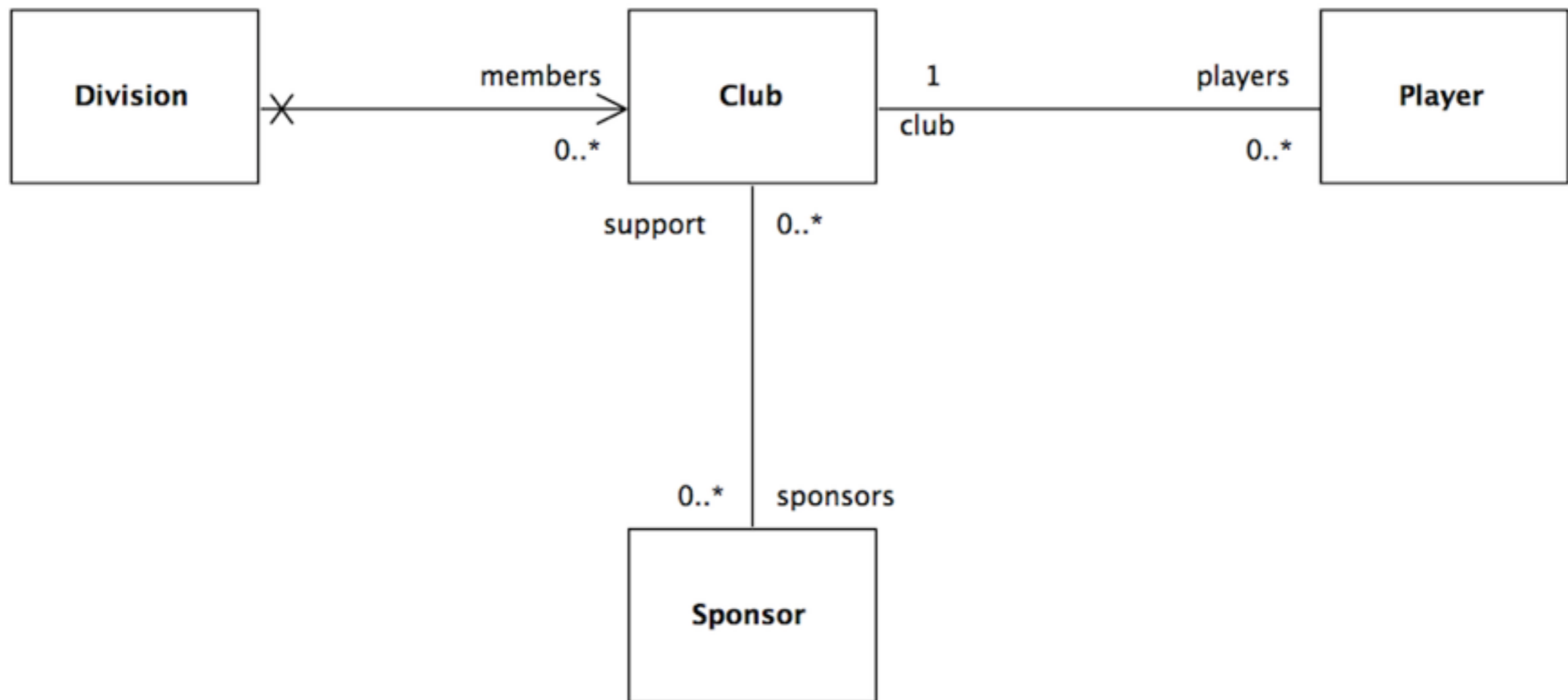
Change Log:

- [Change Log for JSR 317](#)

See Also

- [JSR-000317 Java Persistence 2.0 Detail Page](#)
- [List of Final Releases Page](#)
- [Java Community Process Main Page](#)

OneToMany, ManyToOne, ManyToMany



```

@Entity
public class Division extends Model
{
    @Id
    @GeneratedValue
    public Long id;
    public String name;

    @OneToMany(cascade=CascadeType.ALL)
    public List<Club> membersnew ArrayList<Club>();

    public Division(String name)
    {
        this.name = name;
    }
}

```

```

@Entity
public class Club extends Model
{
    @Id
    @GeneratedValue
    public Long id;
    public String name;

    @OneToMany(mappedBy="club", cascade=CascadeType.ALL)
    public List<Player> players = new ArrayList<Player>();

    @ManyToMany
    public List<Sponsor> sponsors;

    public Club(String name)
    {
        this.name = name;
    }
}

```

```

@Entity
public class Sponsor extends Model
{
    @Id
    @GeneratedValue
    public Long id;
    public String name;

    @ManyToMany (mappedBy="sponsors")
    public List<Club> support new ArrayList<Club>();

    public Sponsor(String name)
    {
        this.name = name;
    }
}

```

```

@Entity
public class Player extends Model
{
    @Id
    @GeneratedValue
    public Long id;
    public String name;

    @ManyToOne
    public Club club;

    public Player(String name)
    {
        this.name = name;
    }

    public String toString()
    {
        return name;
    }

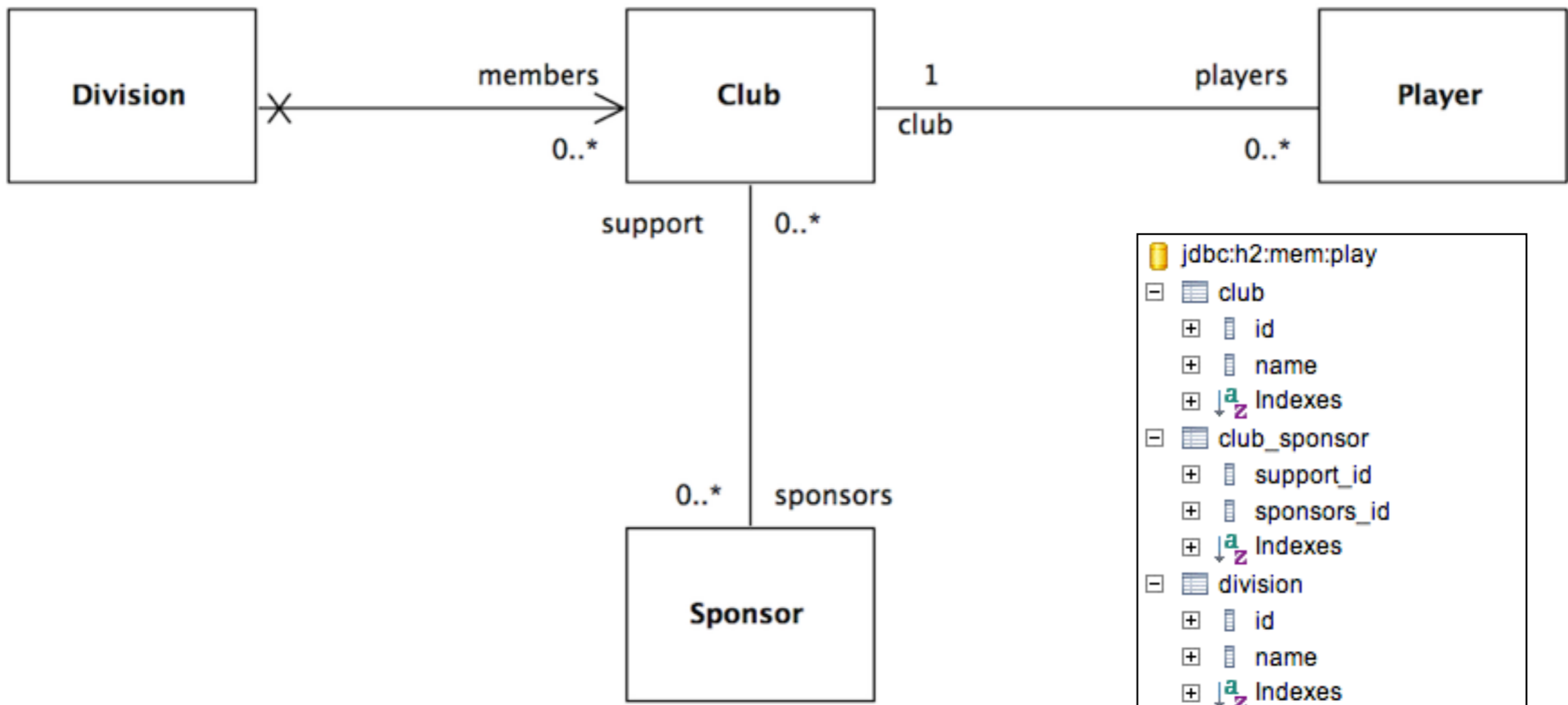
    public static Player findByName(String name)
    {
        return find("name", name).first();
    }
}

```

```

jdbc:h2:mem:play
- club
  + id
  + name
  + Indexes
- club_sponsor
  + support_id
  + sponsors_id
  + Indexes
- division
  + id
  + name
  + Indexes
- division_club
  + division_id
  + members_id
  + Indexes
- player
  + id
  + name
  + club_id
  + Indexes
- sponsor
  + id
  + name
  + Indexes

```



jdbc:h2:mem:play

- club
 - + id
 - + name
 - + Indexes
- club_sponsor
 - + support_id
 - + sponsors_id
 - + Indexes
- division
 - + id
 - + name
 - + Indexes
- division_club
 - + division_id
 - + members_id
 - + Indexes
- player
 - + id
 - + name
 - + club_id
 - + Indexes
- sponsor
 - + id
 - + name
 - + Indexes



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