Difference between JPA, Hibernate, and Spring Data JPA

# 1. Java Persistence API (JPA)

JPA (Java Persistence API) is a specification for object-relational mapping (ORM) in Java. It defines standards for persisting, accessing, and managing data between Java objects and relational databases.  
- JPA itself is just a specification and doesn’t provide implementation.  
- Common annotations: @Entity, @Id, @Table, @GeneratedValue.  
- Requires an implementation such as Hibernate.  
  
Sample Dependency (pom.xml):  
<dependency>  
 <groupId>jakarta.persistence</groupId>  
 <artifactId>jakarta.persistence-api</artifactId>  
 <version>3.1.0</version>  
</dependency>

# 2. Hibernate

Hibernate is the most popular implementation of the JPA specification. It is a full-featured ORM framework that provides advanced capabilities beyond JPA such as caching, lazy loading, and the Hibernate Query Language (HQL).  
- Provides additional APIs beyond JPA.  
- Allows configuration through XML or Java-based configuration.  
  
Sample Dependency (pom.xml):  
<dependency>  
 <groupId>org.hibernate.orm</groupId>  
 <artifactId>hibernate-core</artifactId>  
 <version>6.4.0.Final</version>  
</dependency>  
  
Sample Configuration (hibernate.cfg.xml):  
<hibernate-configuration>  
 <session-factory>  
 <property name="hibernate.connection.driver\_class">org.h2.Driver</property>  
 <property name="hibernate.connection.url">jdbc:h2:mem:testdb</property>  
 <property name="hibernate.dialect">org.hibernate.dialect.H2Dialect</property>  
 <property name="hibernate.hbm2ddl.auto">update</property>  
 <property name="hibernate.show\_sql">true</property>  
 </session-factory>  
</hibernate-configuration>

# 3. Spring Data JPA

Spring Data JPA is a part of the larger Spring ecosystem. It simplifies JPA-based data access layers by reducing boilerplate code through Repository interfaces.  
- Built on top of JPA and Hibernate.  
- Provides CRUD operations out of the box.  
- Requires minimal configuration in Spring Boot.  
  
Sample Dependencies (pom.xml):  
<dependency>  
 <groupId>org.springframework.boot</groupId>  
 <artifactId>spring-boot-starter-data-jpa</artifactId>  
</dependency>  
<dependency>  
 <groupId>com.h2database</groupId>  
 <artifactId>h2</artifactId>  
</dependency>  
  
Sample Repository Interface:  
public interface StudentRepository extends JpaRepository<Student, Long> {  
}