**1. JPA (Java Persistence API)**

**What it is:**

* JPA is a specification (standard interface) for object-relational mapping (ORM) in Java.
* It defines how Java objects should be mapped to relational database tables.
* JPA provides annotations like @Entity, @Table, @Id, etc., and APIs like EntityManager.

**What it does not do:**

* JPA does not include any implementation.
* It requires a provider (like Hibernate) to work.

**Summary:**  
JPA is a standard; it tells you *what* to do, not *how* to do it.

**2. Hibernate**

**What it is:**

* Hibernate is an ORM tool and one of the most popular implementations of the JPA specification.
* It not only supports JPA but also adds additional features like HQL (Hibernate Query Language), caching, and fetching strategies.

**Without Spring:**

* You manually create sessions, begin and commit transactions, and handle exceptions.

**Summary:**  
Hibernate is a concrete tool that actually performs persistence operations using JPA rules (and beyond).

**3. Spring Data JPA**

**What it is:**

* A part of the Spring ecosystem that provides an abstraction over JPA.
* It uses a JPA provider like Hibernate under the hood but simplifies the code needed to work with the database.

**Features:**

* Repository interfaces like JpaRepository provide built-in CRUD methods.
* Custom queries can be defined using method names or @Query annotations.
* It manages transactions and integrates smoothly with Spring Boot.

**Summary:**  
Spring Data JPA reduces boilerplate by allowing you to focus on business logic while it handles persistence automatically.

**Comparison Table**

| **Feature** | **JPA** | **Hibernate** | **Spring Data JPA** |
| --- | --- | --- | --- |
| Type | Specification | Implementation | Framework/Abstraction |
| Boilerplate code | Yes | Yes | No |
| Transactions | Manual | Manual | Managed by Spring |
| Implementation required | Yes | No (it's an implementation) | Yes (uses Hibernate or similar) |
| Use in Spring Boot | Indirectly | Directly or via Spring | Easily via @Repository, @Service |

**Code Example**

**Hibernate:**

java

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Session session = factory.openSession();

Transaction tx = null;

try {

tx = session.beginTransaction();

session.save(employee);

tx.commit();

} catch (Exception e) {

if (tx != null) tx.rollback();

} finally {

session.close();

}

**Spring Data JPA:**

java

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public interface EmployeeRepository extends JpaRepository<Employee, Integer> {}

@Service

public class EmployeeService {

@Autowired

private EmployeeRepositoryemployeeRepository;

@Transactional

public void addEmployee(Employee employee) {

employeeRepository.save(employee);

}

}

**Summary**

* **JPA**: Specification (standard) for Java persistence
* **Hibernate**: Implementation of JPA + extra features
* **Spring Data JPA**: Abstraction over JPA (uses Hibernate) that removes boilerplate and simplifies development