Difference between JPA, Hibernate and Spring Data JPA

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| Aspect | JPA | Hibernate | Spring Data JPA |
| Type | Specification (API only) | Implementation (Library/Framework) | Framework (Extension on top of JPA) |
| Maintained by | Jakarta EE (formerly Java EE) | Red Hat | Pivotal / Spring |
| Purpose | Defines standard ORM mapping & operations | Provides actual ORM logic & advanced features | Simplifies repository layer & CRUD operations |
| Core artifact | `javax.persistence.\*` annotations & interfaces | `org.hibernate.\*` classes | `org.springframework.data.jpa.repository.\*` |
| Implements JPA? | Not applicable | Yes, implements & extends it | Uses JPA & an implementation (like Hibernate) underneath |
| Vendor-neutral? | Yes | Vendor-specific (Hibernate only) | Works with any JPA provider |
| Extra features? | None (only standard spec) | Yes: advanced caching, HQL, custom dialects, second-level cache, batch processing | Yes: query method generation, dynamic queries, paging, sorting |
| Boilerplate reduction | No | Partial | Major boilerplate reduction |
| Repositories | You write EntityManager code manually | You can use Hibernate APIs or EntityManager | You write interfaces only; Spring auto-implements at runtime |
| Custom Queries | JPQL | HQL (Hibernate Query Language) or JPQL | JPQL, derived query methods, @Query |
| Learning curve | Medium | Medium-high (more config options) | Easiest for CRUD & repo layer |
| Transaction Management | Provided by JPA, needs config | Supported, works with JTA or Spring TX | Fully integrated with Spring TX |
| Popular alternatives | - | EclipseLink, OpenJPA | Spring Data JDBC, Spring Data MongoDB |
| Example | @Entity, EntityManager | SessionFactory, CriteriaBuilder | JpaRepository<Customer, Long> |
| When to use | When you want portability & standardization | When you want full control & advanced features | When you want rapid dev & minimal boilerplate |
| Use alone? | No | Yes | No (depends on JPA + an implementation) |