ETH Eidgenössische Technische Hochschule Zürich Swiss Federal Institute of Technology Zurich
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Making Applications Persistent at Run-time

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Cluster4

http://prose.ethz.ch

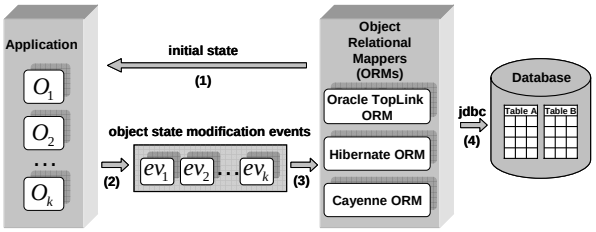
- Persistence has become a common requirement in many applications
- Persistence is an orthogonal concern typically implemented by the underlying middleware infrastructure and not by the application developer
- In existing systems, persistence is added to an application either at compile or deployment time by using a variety of mechanisms

- **Orthogonal Persistence** – implemented as:
  - Language extensions
  - A development time property (e.g., ORMs)
  - A deployment time property (e.g., container)
  - A compile time property

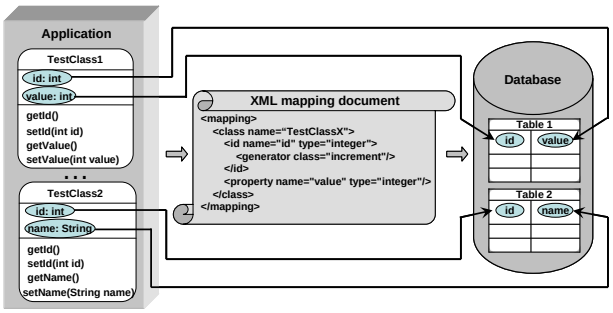
- **Contributions – Dynamic Persistence:**
  - A Java-based dynamic AOP infrastructure where persistence functionality can be dynamically added or removed from running applications
  - Persistence as a run-time property
  - Persistence behavior can be added to existing applications without requiring to modify their original code
  - Making the application independent of the container
  - Application can be made persistent at run-time without having to stop or redeploy the code

Dynamic Persistence

Architecture for object persistence



Mapping application objects to tables



Persistence as an aspect

```
public class PersistenceAspect extends DefaultAspect {
    public SessionFactory sf;
    public Crosscut makePersistent = new SetCut() {
        // advice method: runs before field modifications of type "Integer"
        public void SET_ARGS(Object obj, Integer f) {
            Session ses = sf.openSession();  // session handling
            ses.saveOrUpdate(obj);           // object writes or updates
            ses.flush();
            ses.connection().commit();  // commit the changes into the database
            ses.close();
        }
        protected PointCutter pointCutter() {
            return (   (Fields.declaredInClass("Service.*"))  .AND
                       (Fields.named("field.*")) );
        }
    }
}
```

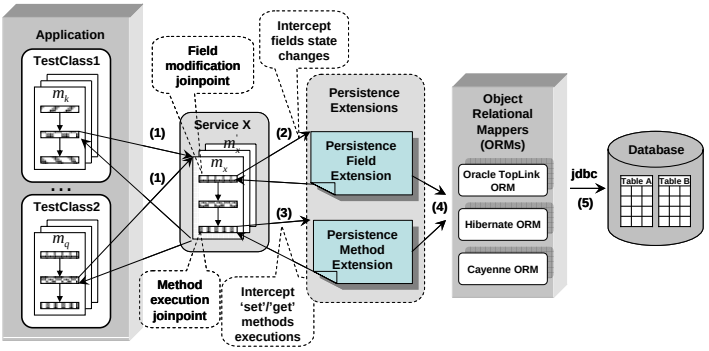
Integer *.*

advice method

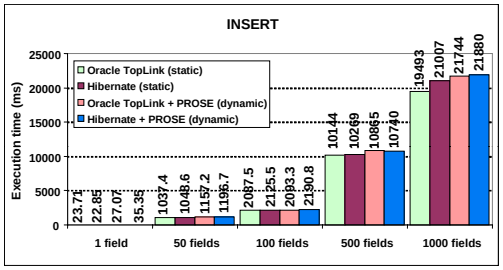
before field modification: declaredInClass(Service.*) && named(field.*)

pointcut method

Adapting running applications

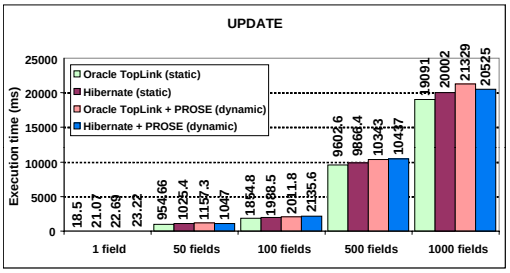


Performance evaluation



INSERT measurements with Oracle TopLink, Hibernate and PROSE with Sun JVM

- Performance penalty: the AOP support leads to an average overhead of 8.92 % in case of Oracle TopLink



UPDATE measurements with Oracle TopLink, Hibernate and PROSE with Sun JVM

- Performance penalty: the AOP support leads to an average overhead of 14.35 % in case of Oracle TopLink

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