Java Object Persistence

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Object Databases

Object Databases are systems that provide:

- Persistent store for objects and object graphs.
- Transactional semantics for object storage and retrieval.
- Query mechanism to retrieve objects.
- Transparent handling of references.

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- Prevalent system is updated through transactions.
- Transactions are serialized as journals.
- No rollback. Pre-check prior to updating system.
- Snapshot of entire object graph may be taken.
- System is restored by replaying journal files and snapshots in sequence.
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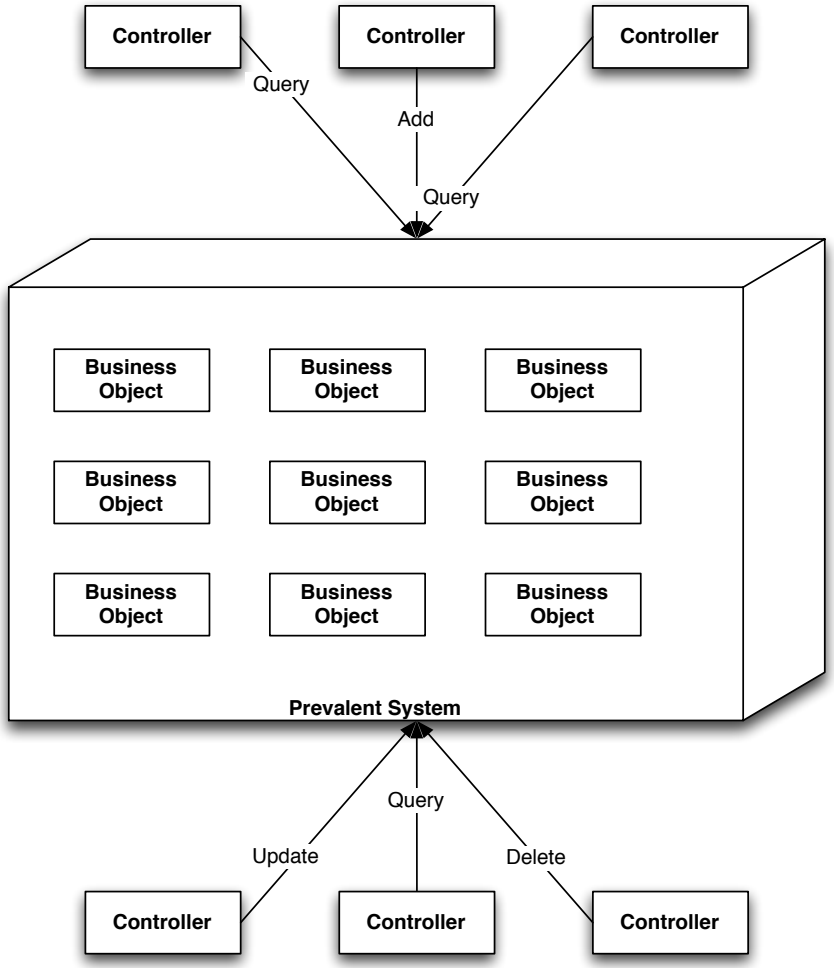
- Prevalent system responsible for storage, indexing, ...
- You implement an object database using Prevayler.
- Available for non-Java platforms.

Prevalent System



PrevalentSystem.java

```
try
{
  final String directory = System.getProperty(
      DATA_DIRECTORY, DEFAULT_DIRECTORY );
  prevayler = PrevaylerFactory.createPrevayler(
      new TimeSystem(), directory );
}
catch ( Throwable t )
{
  throw new RuntimeException( t );
}
```

TimeSystem.java

```
class TimeSystem implements Serializable
{
   private long objectId;
   private Map<Long,Time> map =
     new LinkedHashMap<Long,Time>();
   public Time add( final Time time )
     throws DuplicateException
   {
     check();
     time.setObjectId( objectId++ );
     map.put( objectId, time );
     return time;
   }
}
```

AddTime.java

```
public class AddTime implements
  org.prevayler.TransactionWithQuery
{
 private final Time time;
 public AddTime( final Time time )
 {
  this.time = time;
 }
 public Object executeAndQuery(final Object system,
   final Date executionTime ) throws Exception
 {
  return ((TimeSystem)system).addTime( time );
 }
}
```

Client.java

```
import ...AddTime;
import ...PrevalentSystem;
public class Client
{
  public void add()
  {
    Time time = new Time();
    time.setXXX( ... );
    PrevalentSystem.getPrevayler().
      execute( new AddTime( time ) );
  }
}
```

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Rules for Business Objects

- Must be serializable.
- Implement `hashCode` method.
- Object graphs only through key fields. Direct object references become local copies due to nature of serialization.

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- Must be deterministic.

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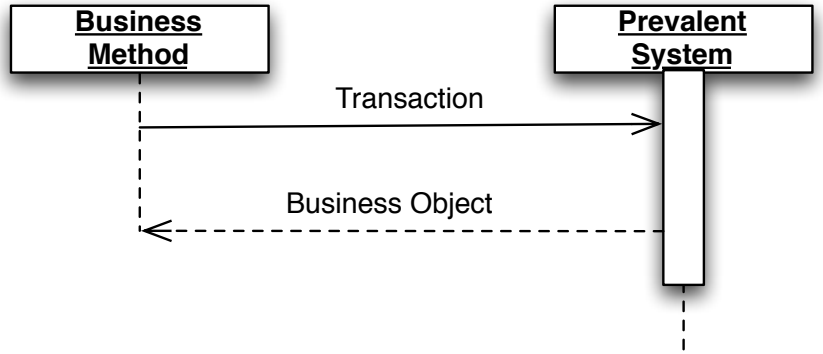
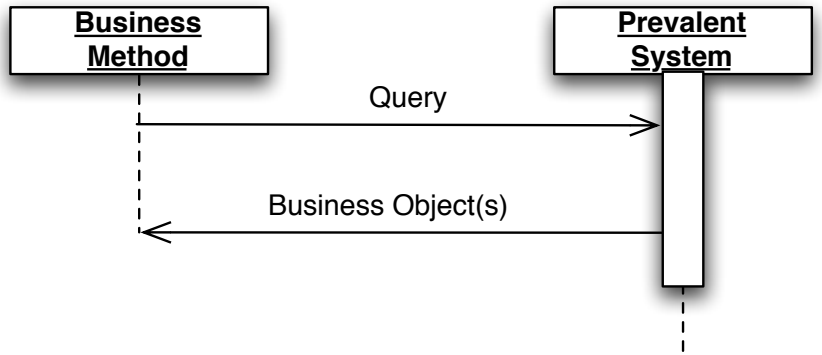
Things to avoid

- `System.currentTimeMillis()`
- `Object.hashCode()` default implementation.
- Iterators of Hashtable, HashMap, or HashSet.
- No Random without a deterministic seed.
- No hardware or network access directly.

Interactions





When to use Prevayler

- Small data set. All data fits into memory.
- Business objects are simple without too many interdepencies.
- Simple querying requirements.
- Application start-up time is not critical.
- You require high degree of fault tolerance over and above direct object serialization.

Disadvantages

- All data must fit into memory.
- Business objects cannot hold direct business object references.
- Requires creation of transaction and query objects.

- Long start-up time while prevalent system is reinstated from snapshot and journals.
- Storage and indexing must be handled in implemented prevalent system.
- No schema evolution.

Disadvantages

- All data must fit into memory.
- Business objects cannot hold direct business object references.
- Requires creation of transaction and query objects.
  - Dynamic proxies may be used to represent transaction and query objects.
  - Related project Finevayler available that removes some of these inconveniences.
- Long start-up time while prevalent system is reinstated from snapshot and journals.
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What is ObjectDB?

- A pure Java Object Database.
- Embedded or client-server modes.
- JDO 2.1 and JPA 1.0 (partial) compliant.

- Seamlessly persist and retrieve complex object graphs.
- No huge memory requirements.
- Performance many times that of MySQL/Oracle/...
- ObjectDB Explorer tool provides database management features.
- Very responsive support.

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- A pure Java Object Database.
- Embedded or client-server modes.
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- Seamlessly persist and retrieve complex object graphs.
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Advantages of Object Databases

- Seamlessly persist complex object graphs.
- Performance orders of magnitude higher than relational databases.
- Extremely efficient handling of object references.

- Domain specific object modelling.
- No OR mapping - quick development cycle.
- Programmer's system, no DBA's required.

Advantages of Object Databases

- Seamlessly persist complex object graphs.
- Performance orders of magnitude higher than relational databases.
- Extremely efficient handling of object references.
  - Composite objects may be used to achieve extreme performance.
  - No join queries required.
- Domain specific object modelling.
- No OR mapping - quick development cycle.
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Disadvantages of Object Databases

- Restricted query language.

- No bulk data loaders and transformers.
- Cumbersome data management processes.
- No stored procedures.
- No job security.

Disadvantages of Object Databases

- Restricted query language.
  - Poor join performance.
  - Join queries are used to fetch loosely related objects.
  - Poor performance of ad-hoc queries.
- No bulk data loaders and transformers.
- Cumbersome data management processes.
- No stored procedures.
- No job security.

Links

- Prevayler
- Finevayler
- ObjectDB
- db4o - JPOX provides an adapter for db4o.
- MyOODB
- JODB