JavaPolis 2003

Transactions and J2EE

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The Answer to Your Questions

- **What is a transaction?**
- **Different transaction types?**
- **How can J2EE manage transactions?**

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- **Training**
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- Host based technology
- Database consolidation
- Reuse & integration

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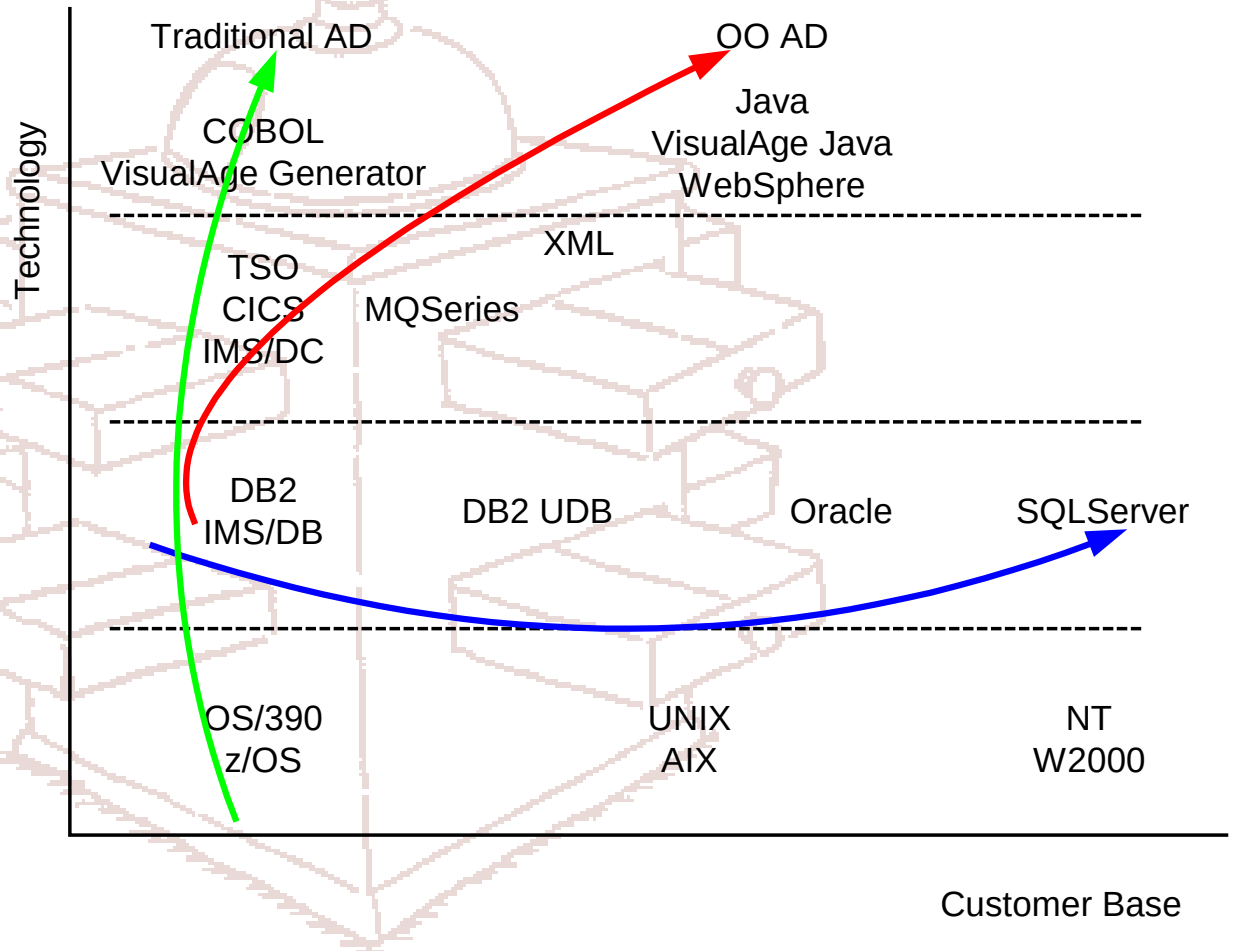


Agenda

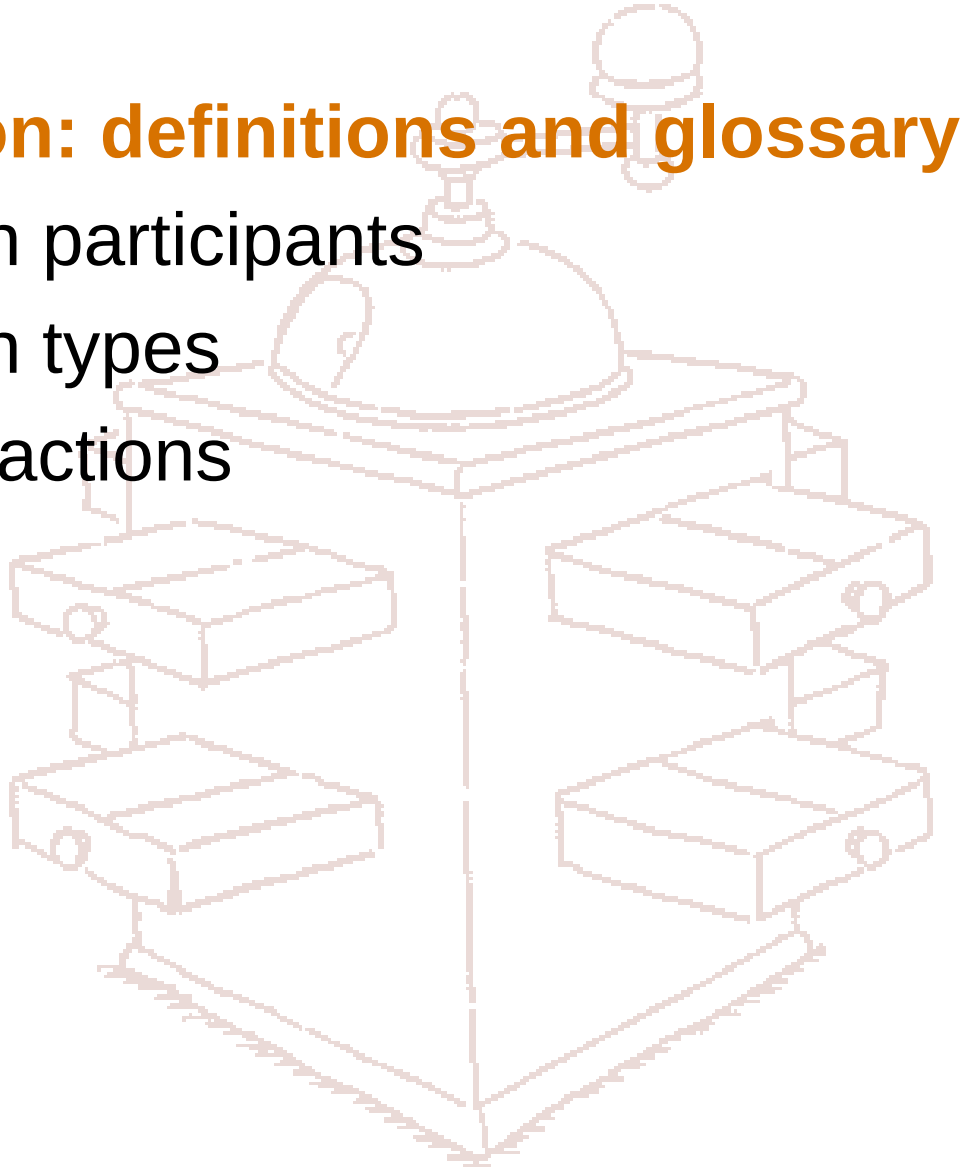
Transaction: definitions and glossary

Transaction participants

Transaction types

J2EE transactions

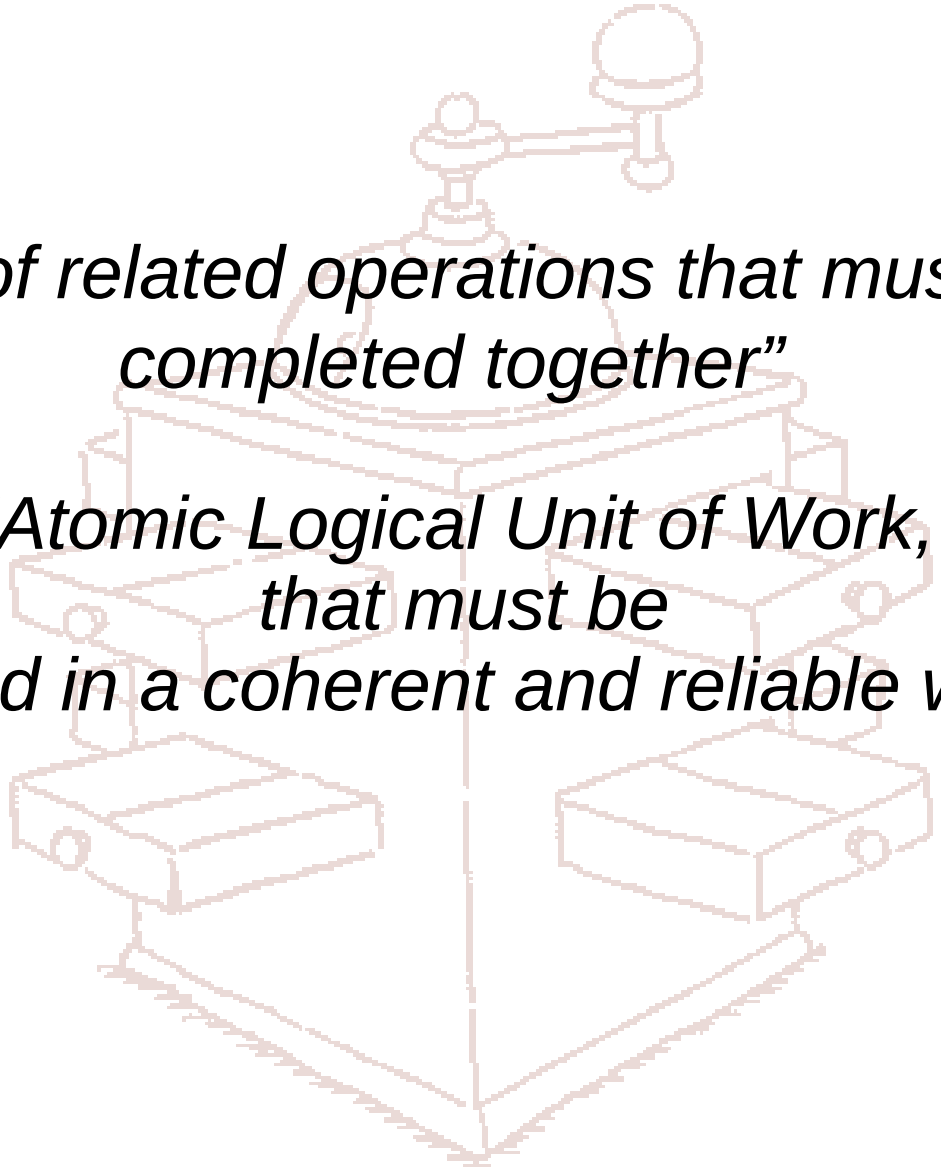
Q & A



Transaction: Definitions

"Set of related operations that must be completed together"

"Atomic Logical Unit of Work,
that must be
treated in a coherent and reliable way."



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Transaction: Glossary

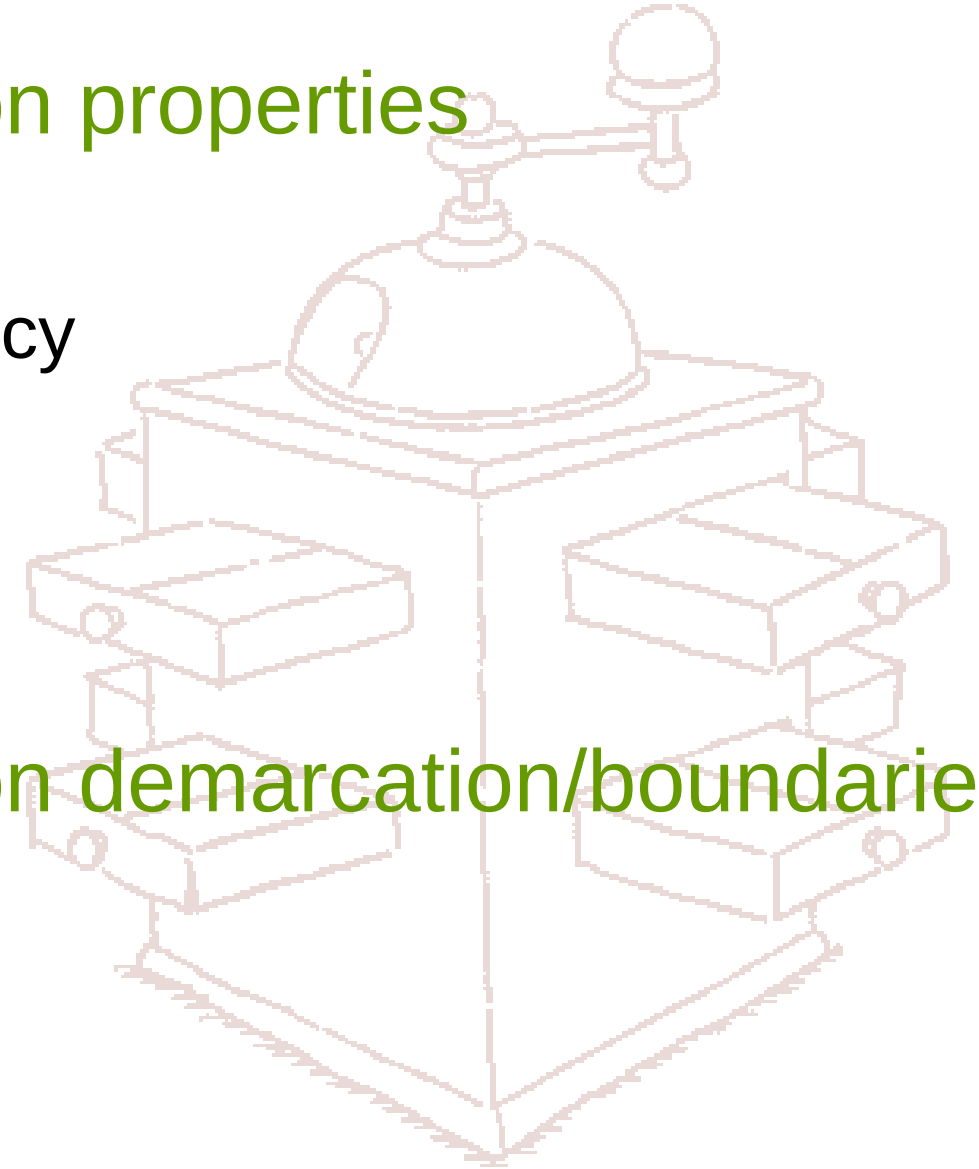
Transaction properties

A tomicity

C onsistency

I solation

D urability



Transaction demarcation/boundaries

Commit

Rollback

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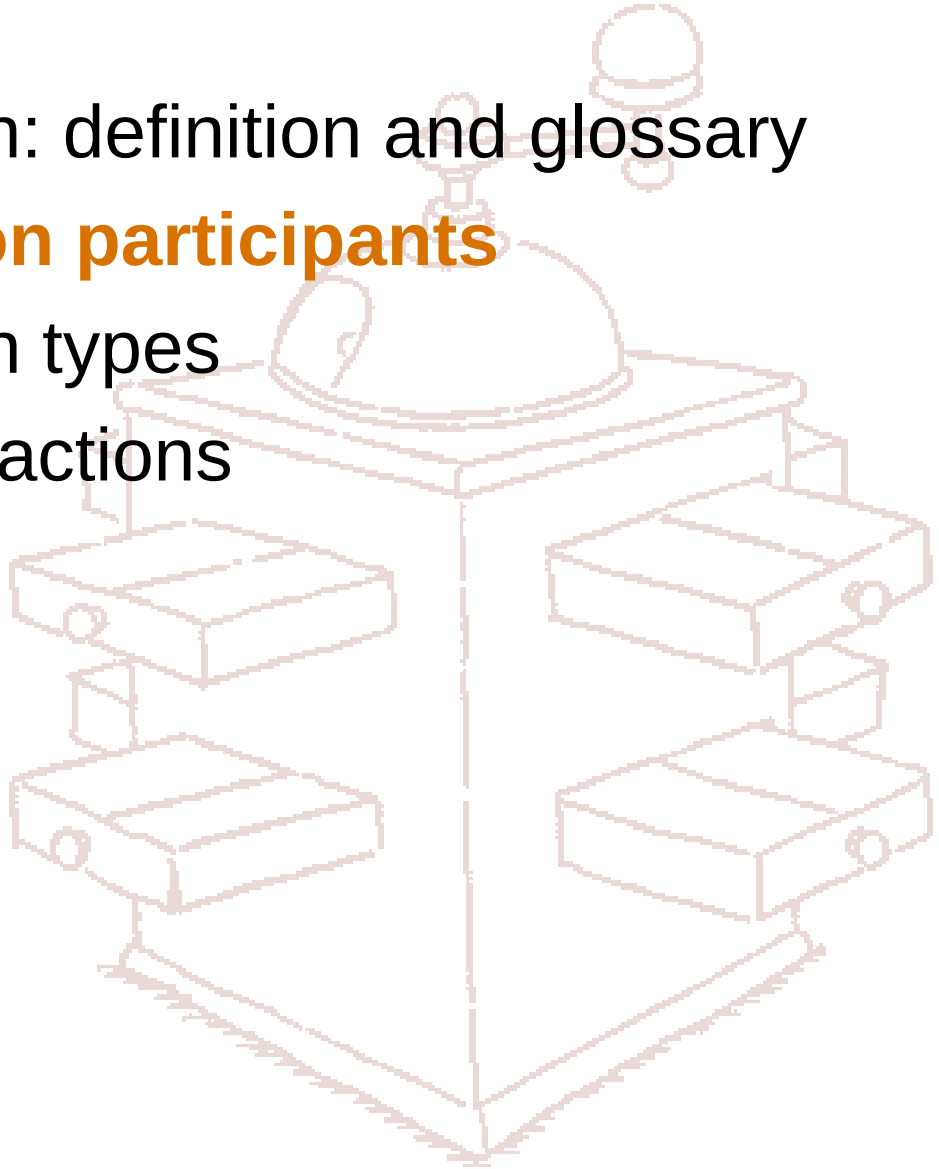

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Transaction Participants

Application

Resource manager

- Relational database
- TP monitor
- JMS provider

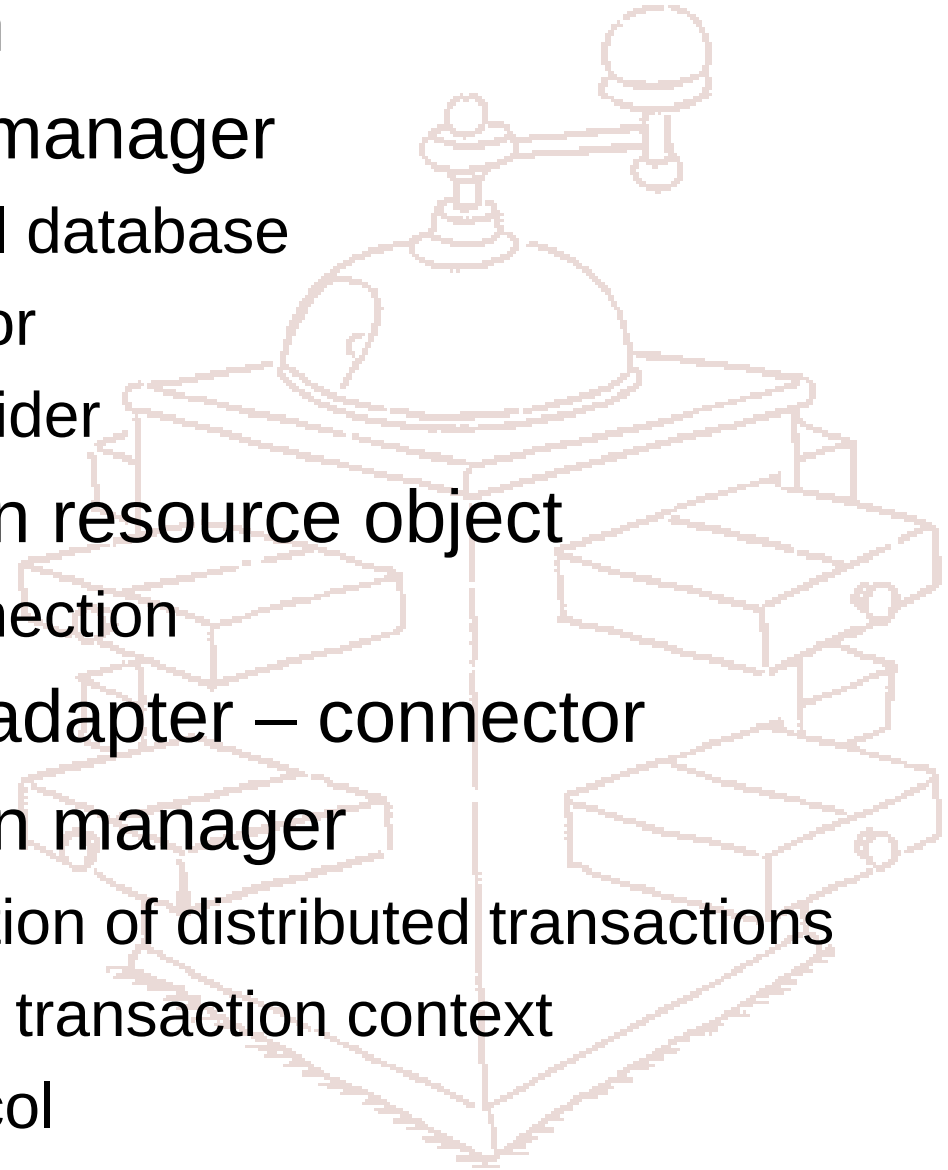
Transaction resource object

- E.g. Connection

Resource adapter – connector

Transaction manager

- Coordination of distributed transactions
- Maintains transaction context
- XA protocol



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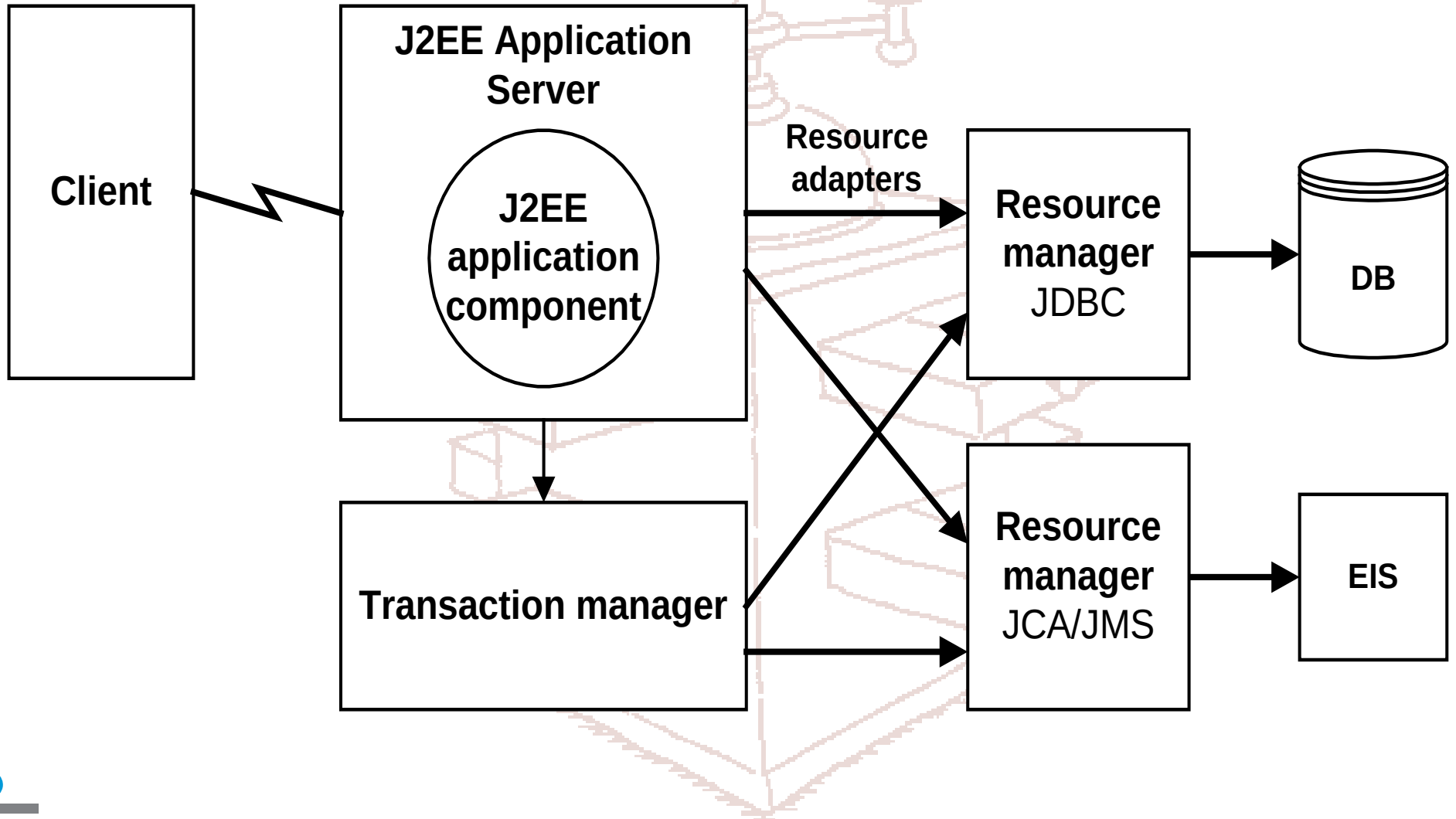
Transaction Participants



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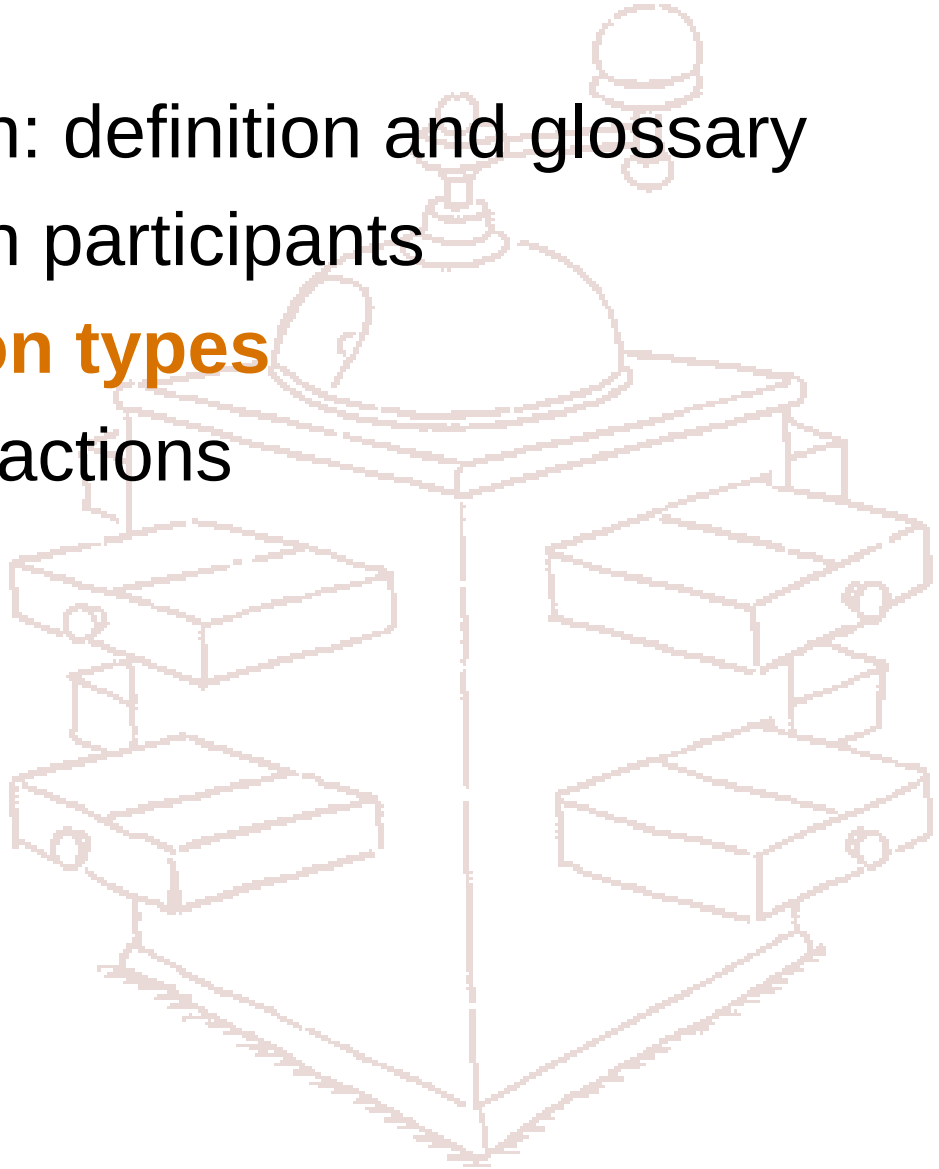

Transaction: definition and glossary

Transaction participants

Transaction types

J2EE transactions

Q & A

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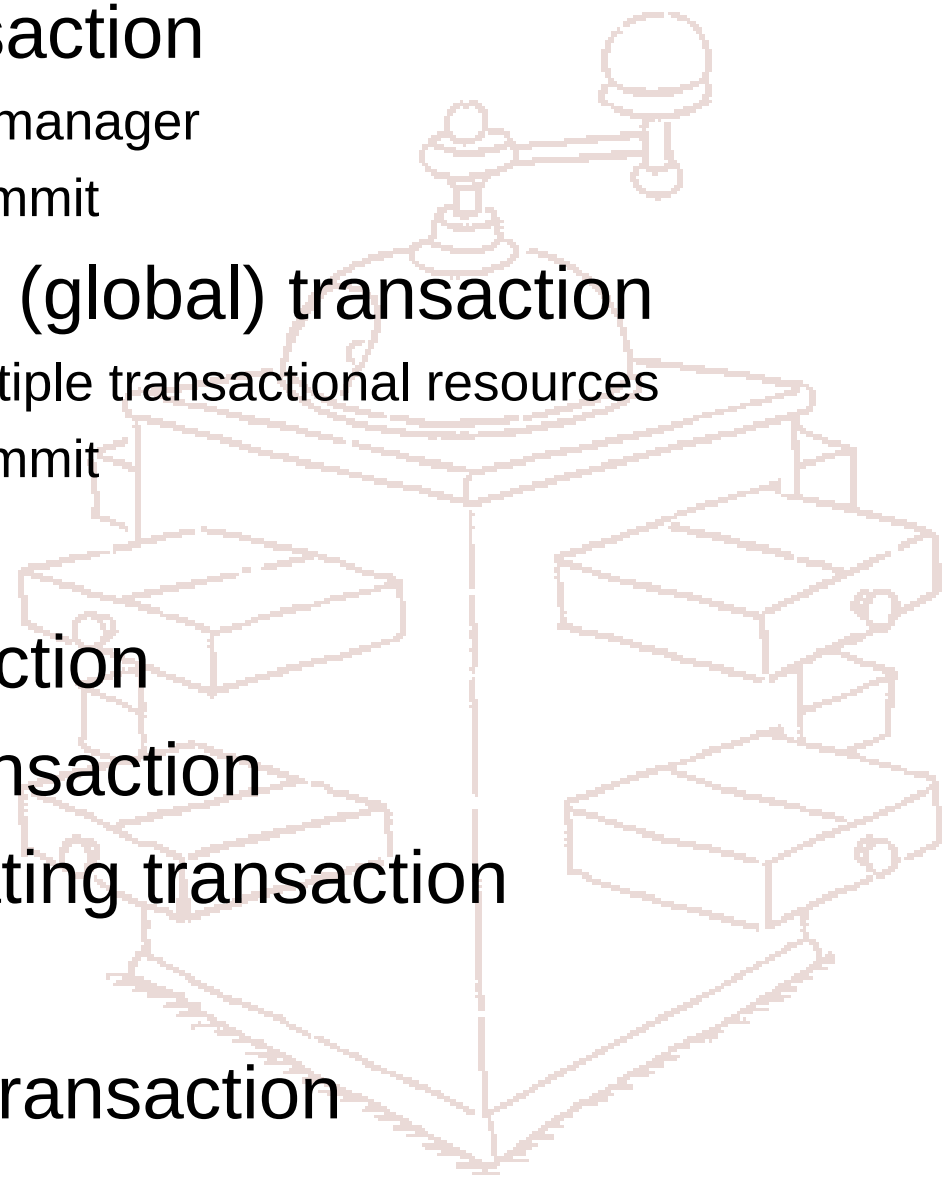
Transaction Types

Local transaction

- 1 resource manager
- 1 phase commit

Distributed (global) transaction

- Access multiple transactional resources
- 2 phase commit



Flat transaction

Nested transaction

Compensating transaction

Extended transaction

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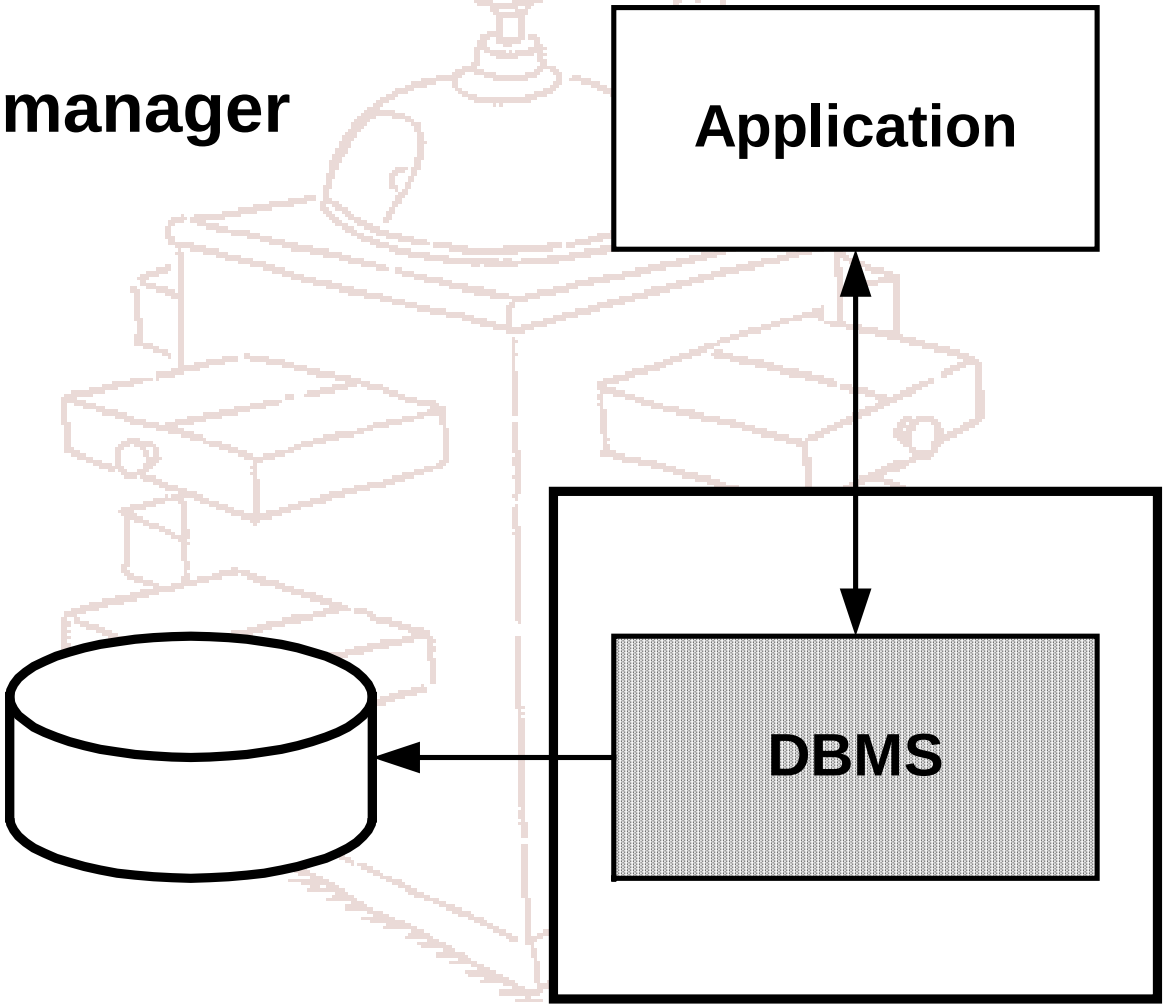
Local Transaction

1 resource manager



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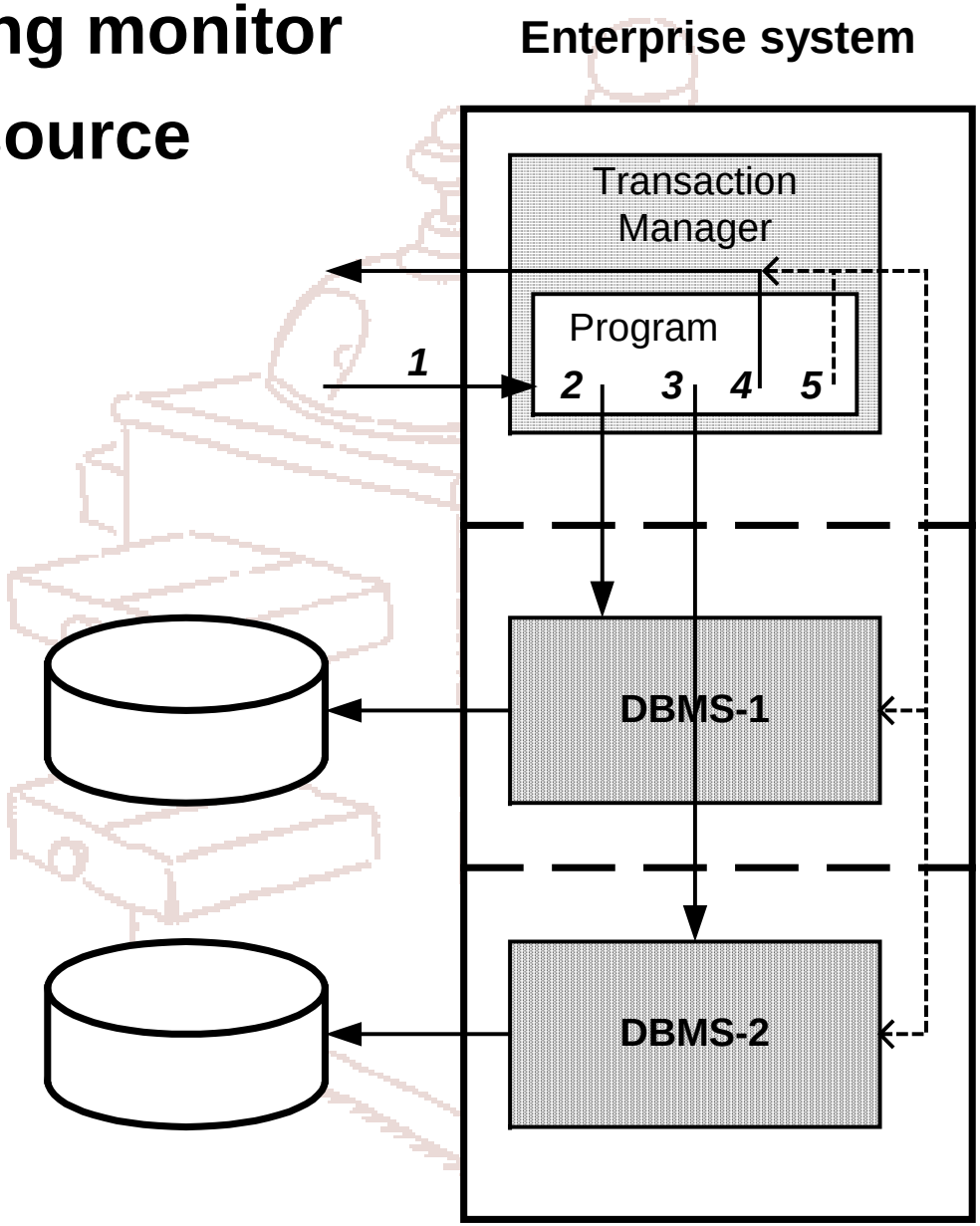
Traditional Transaction Manager

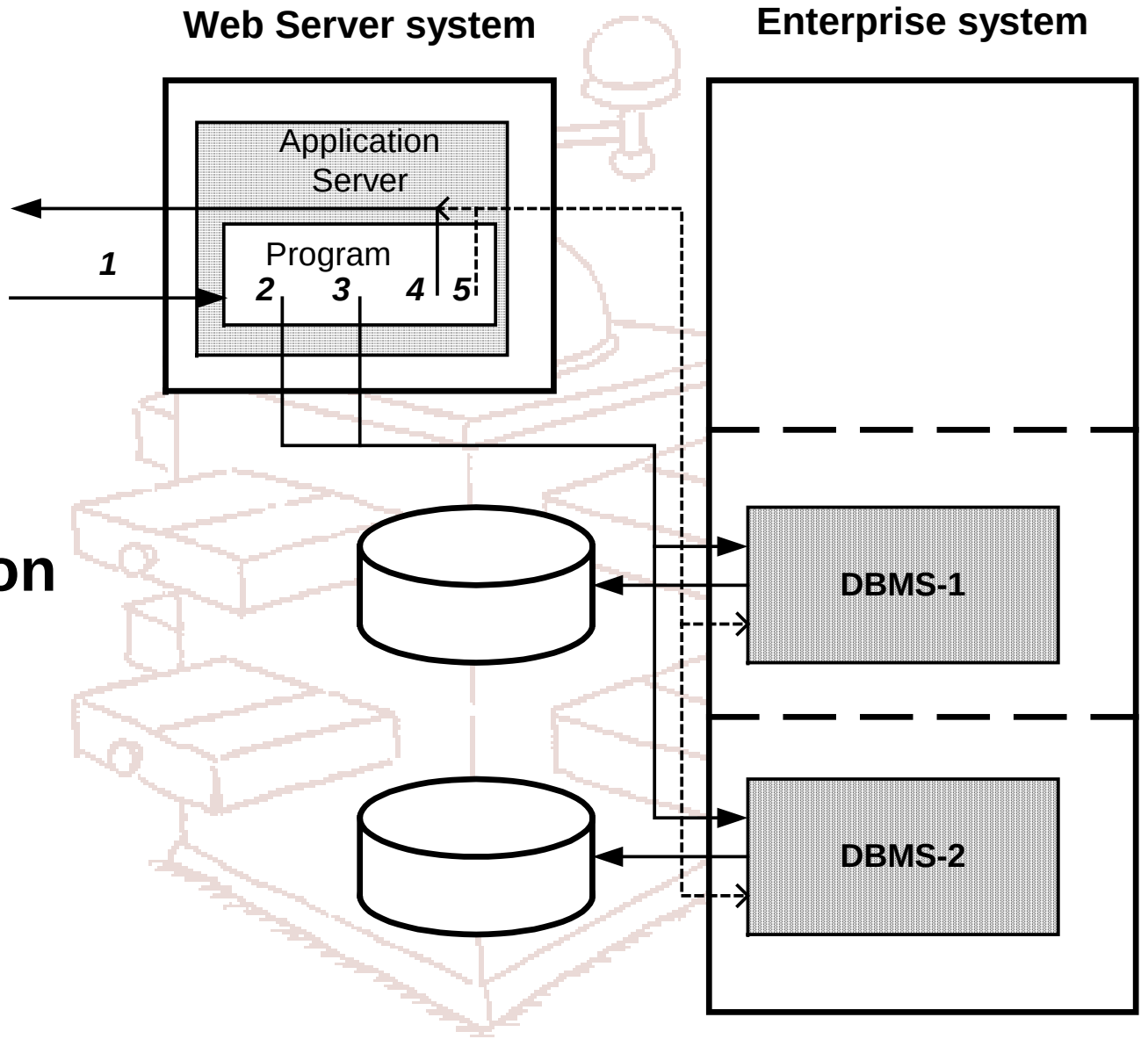
TeleProcessing monitor

+ multiple resource managers



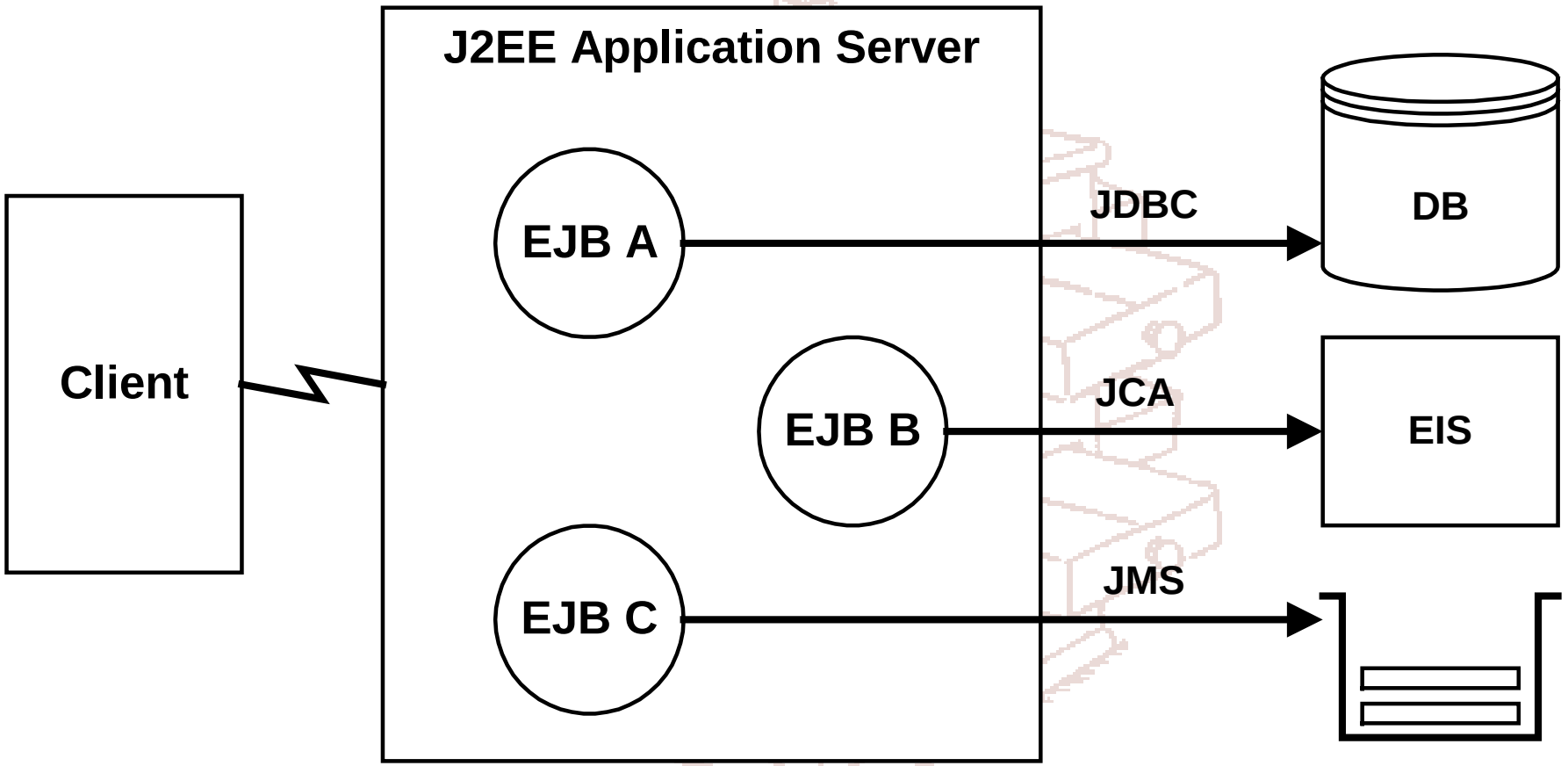
Application Server As Transaction Manager

J2EE application server



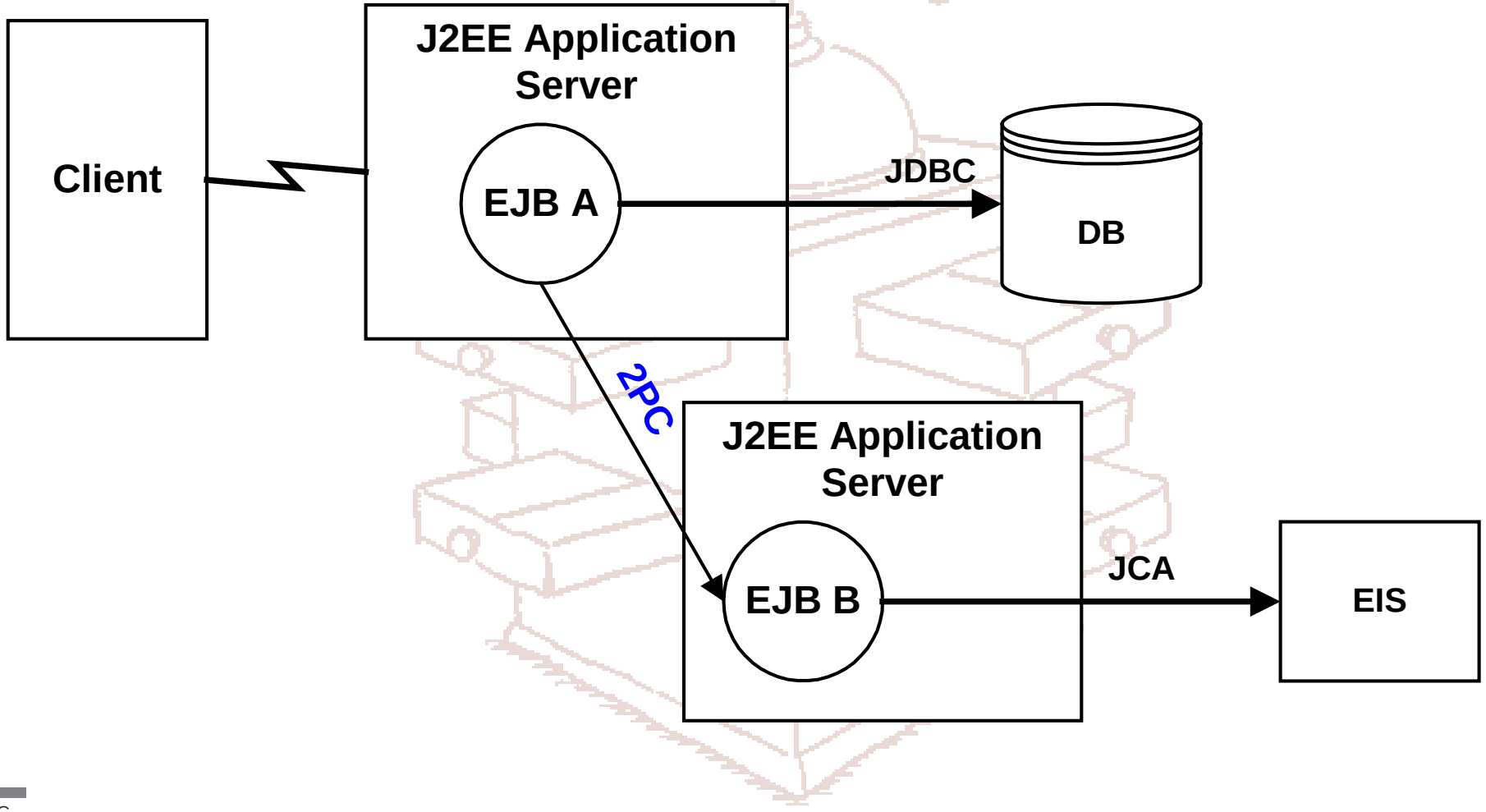
Distributed Transaction

Multiple resource managers



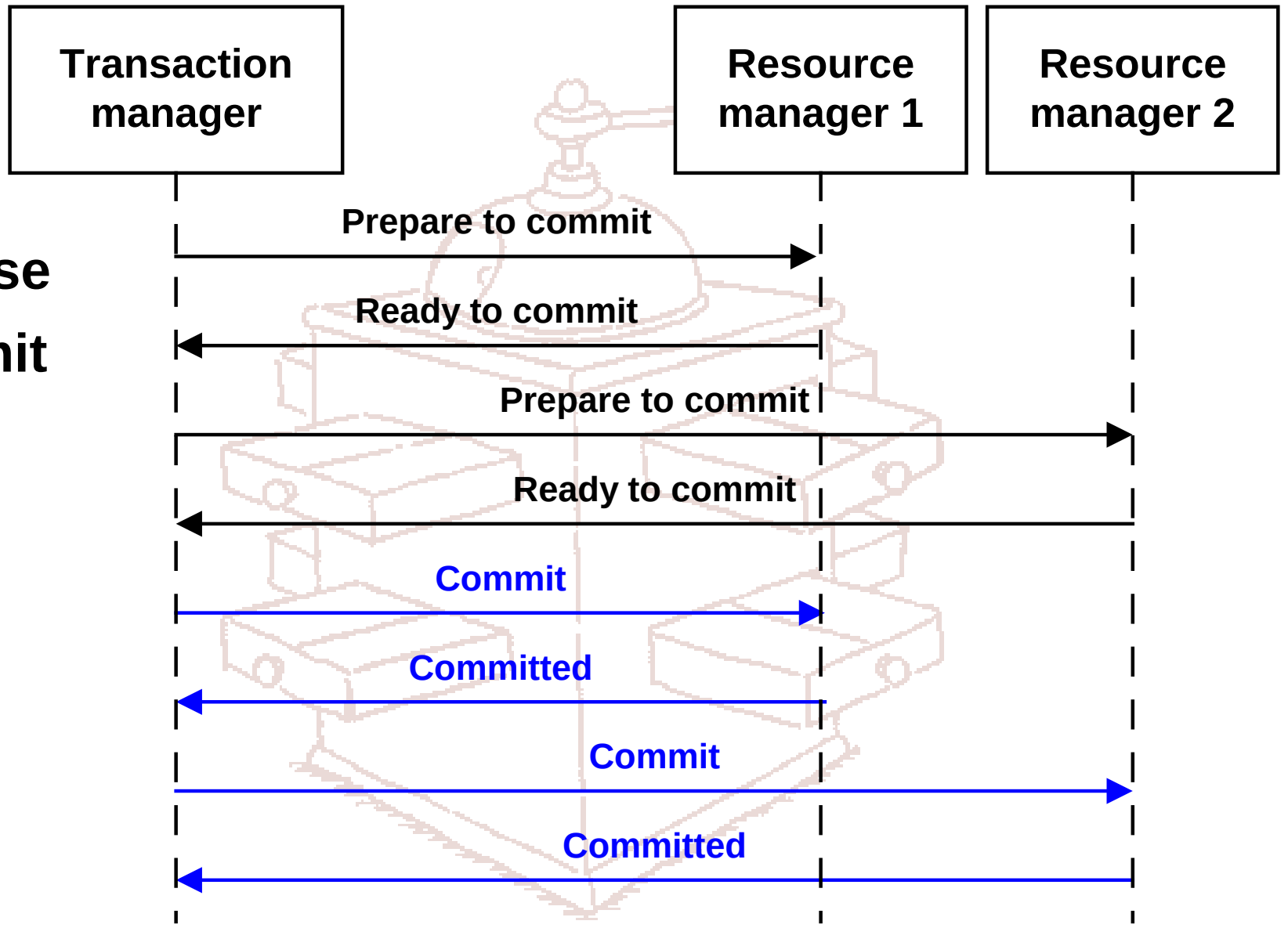
Distributed Transaction

Multiple transaction managers

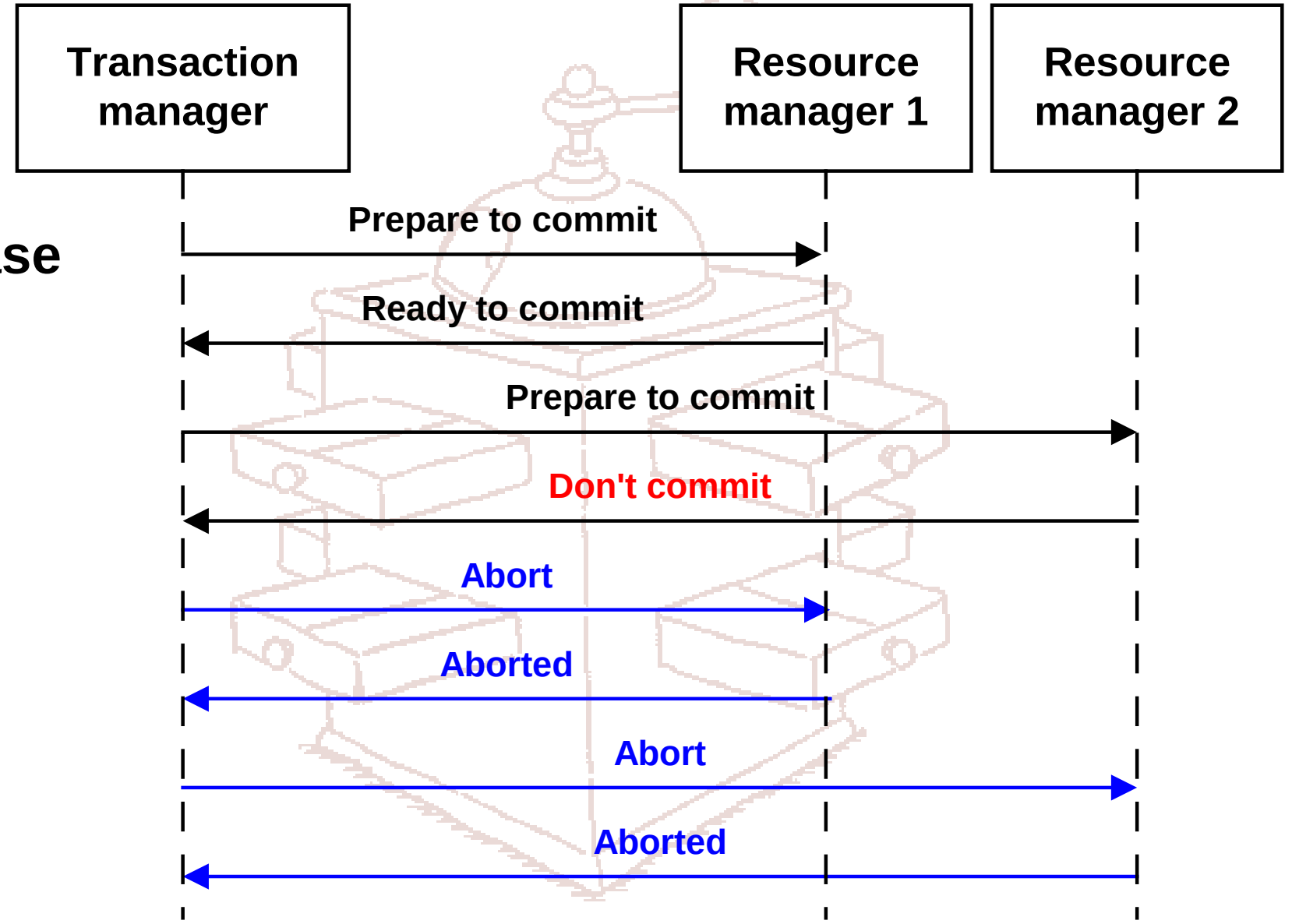


Distributed Transaction

2 Phase Commit



Distributed Transaction



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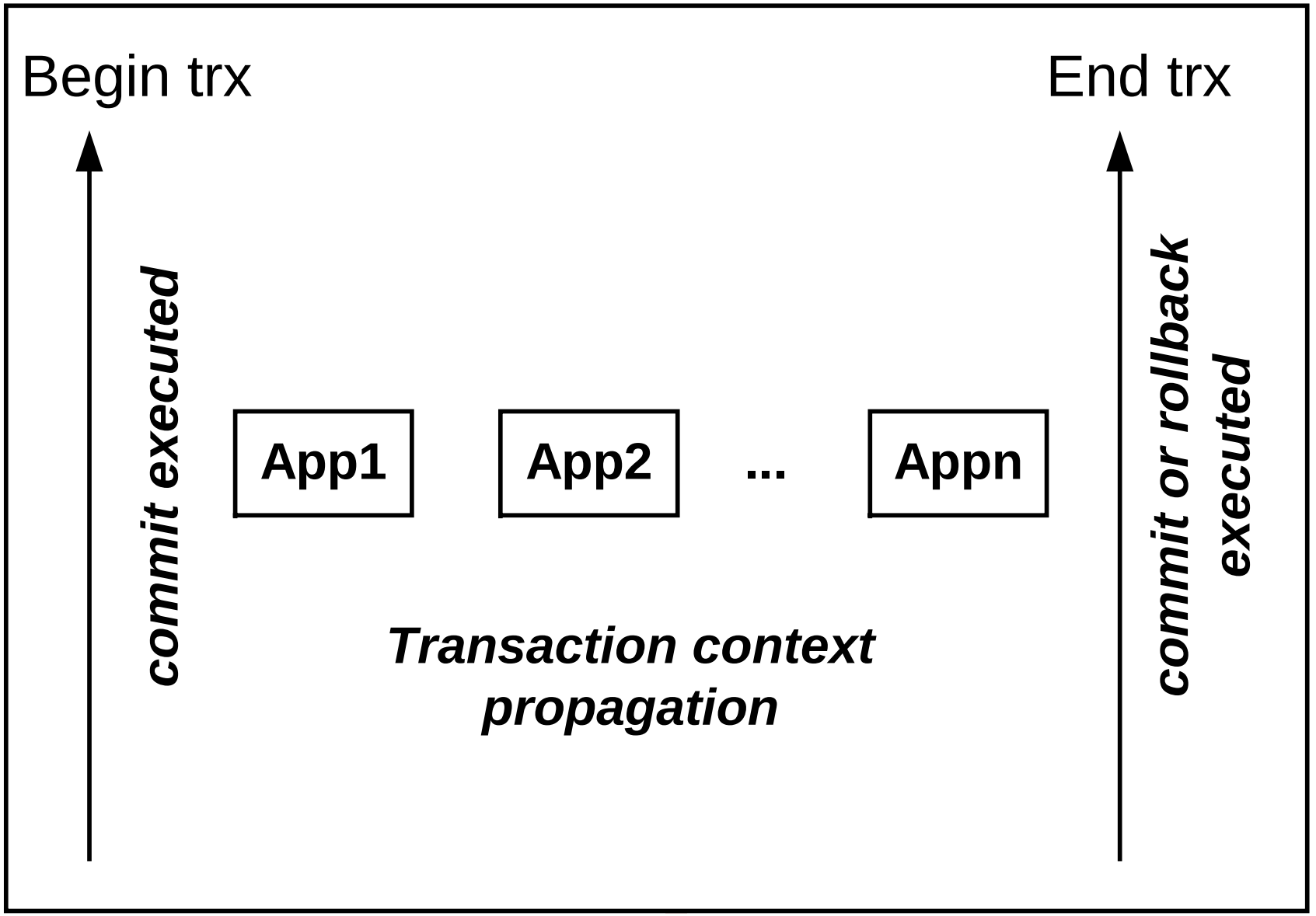
Flat Transaction



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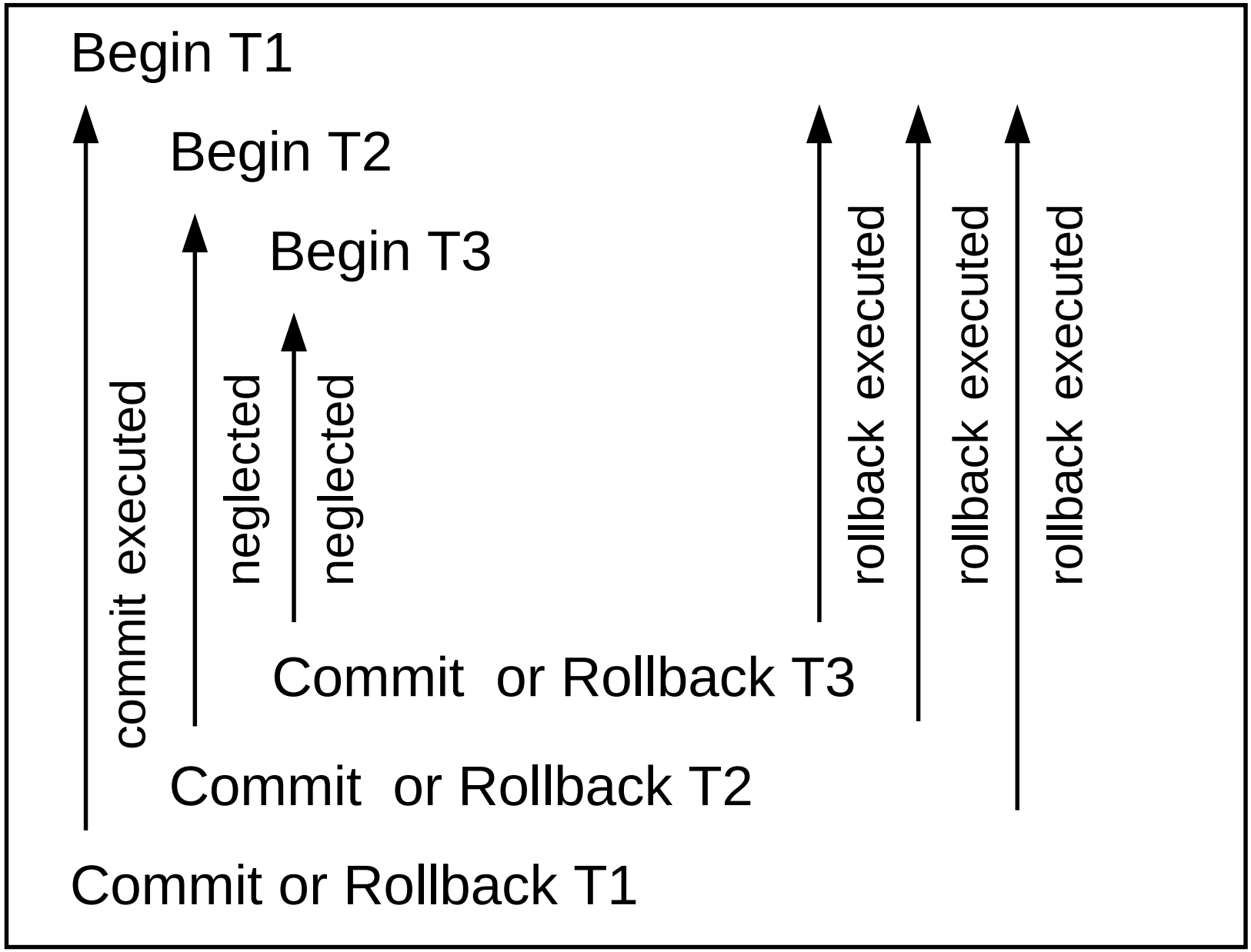
Nested Transaction



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Compensating Transaction

Undo effect of previously committed transaction

- for local transactions (resource adaptors)
- programmatic application logic

Example

```
updateEIS();
try {
    usertrx.begin();
    updateRDBMS();
    usertrx.commit();
}
catch (RollbackException ex) {
    undoUpdateEIS();
}
```

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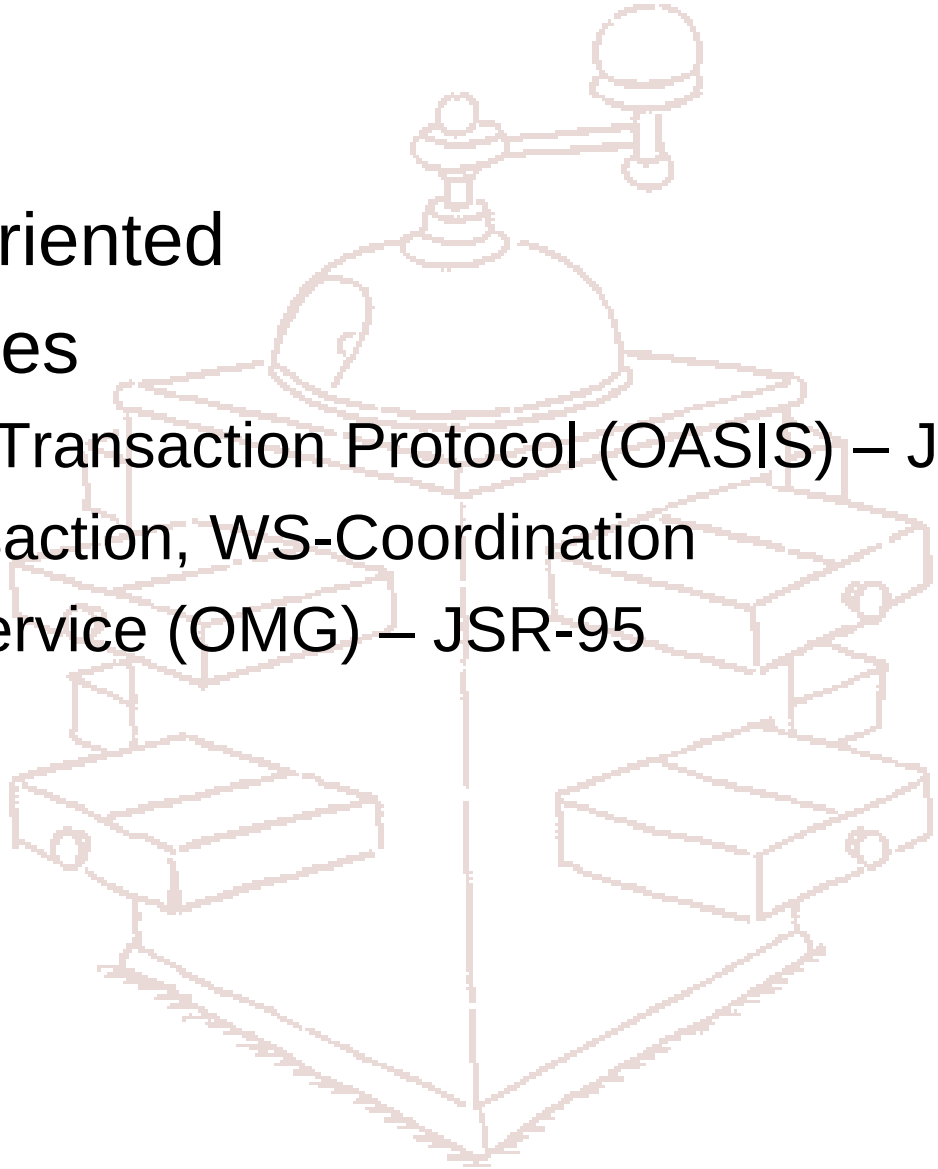
Extended Transaction

Long lived

Message oriented

Web services

- Business Transaction Protocol (OASIS) – JSR-156
- WS-Transaction, WS-Coordination
- Activity Service (OMG) – JSR-95



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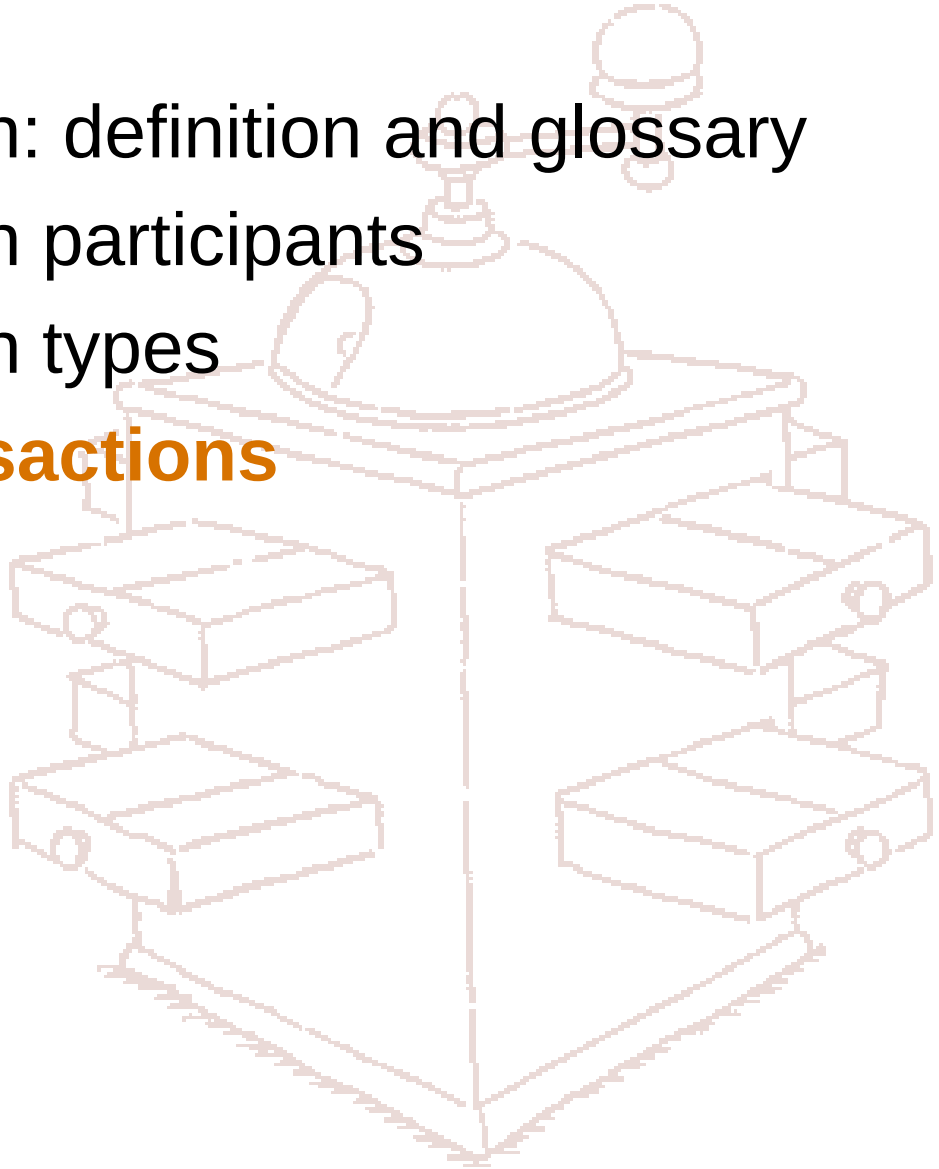

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J2EE Transactions

J2EE Technology

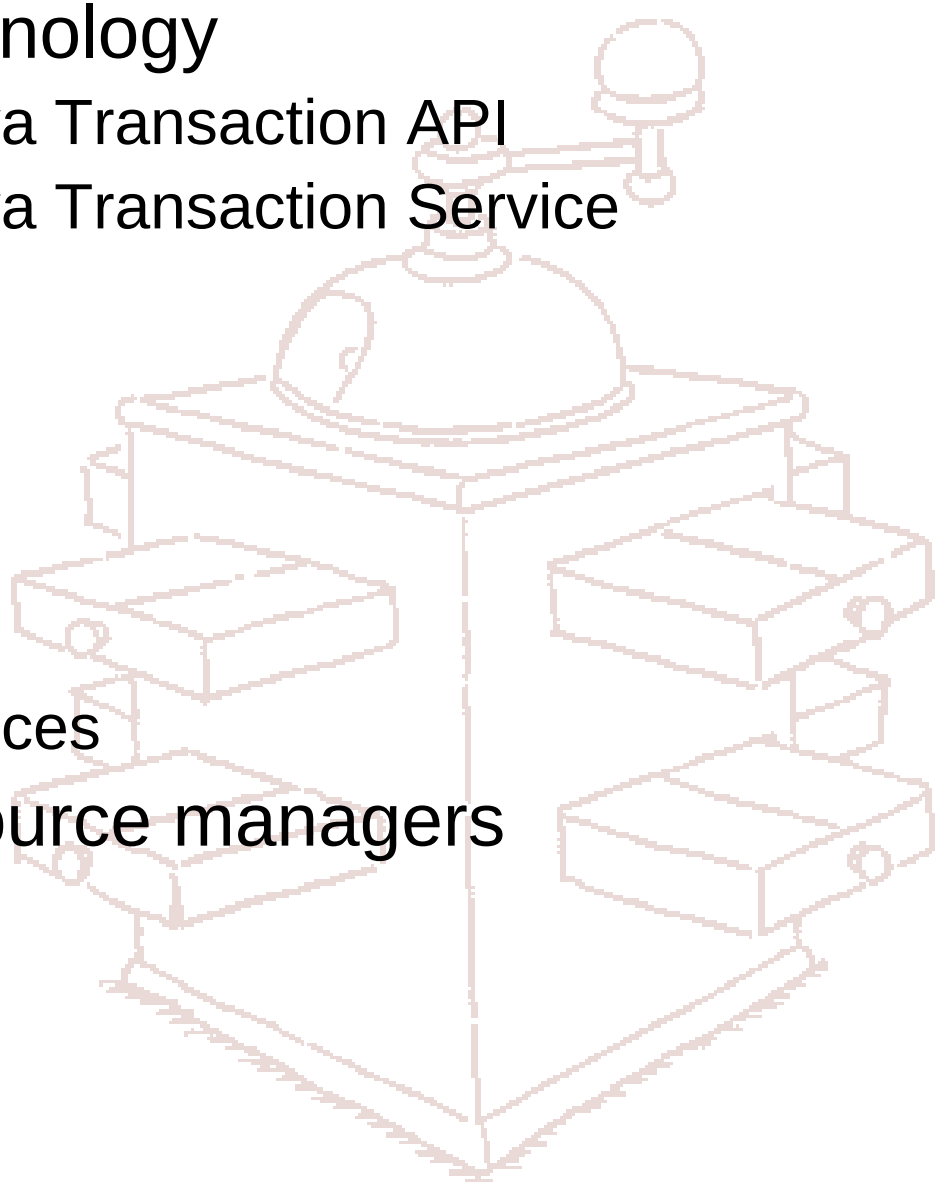
- JTA – Java Transaction API
- JTS – Java Transaction Service

J2EE tiers

- Client tier
- Web tier
- EJB tier
- EIS tier
- Web services

J2EE Resource managers

- JDBC
- JCA
- JMS



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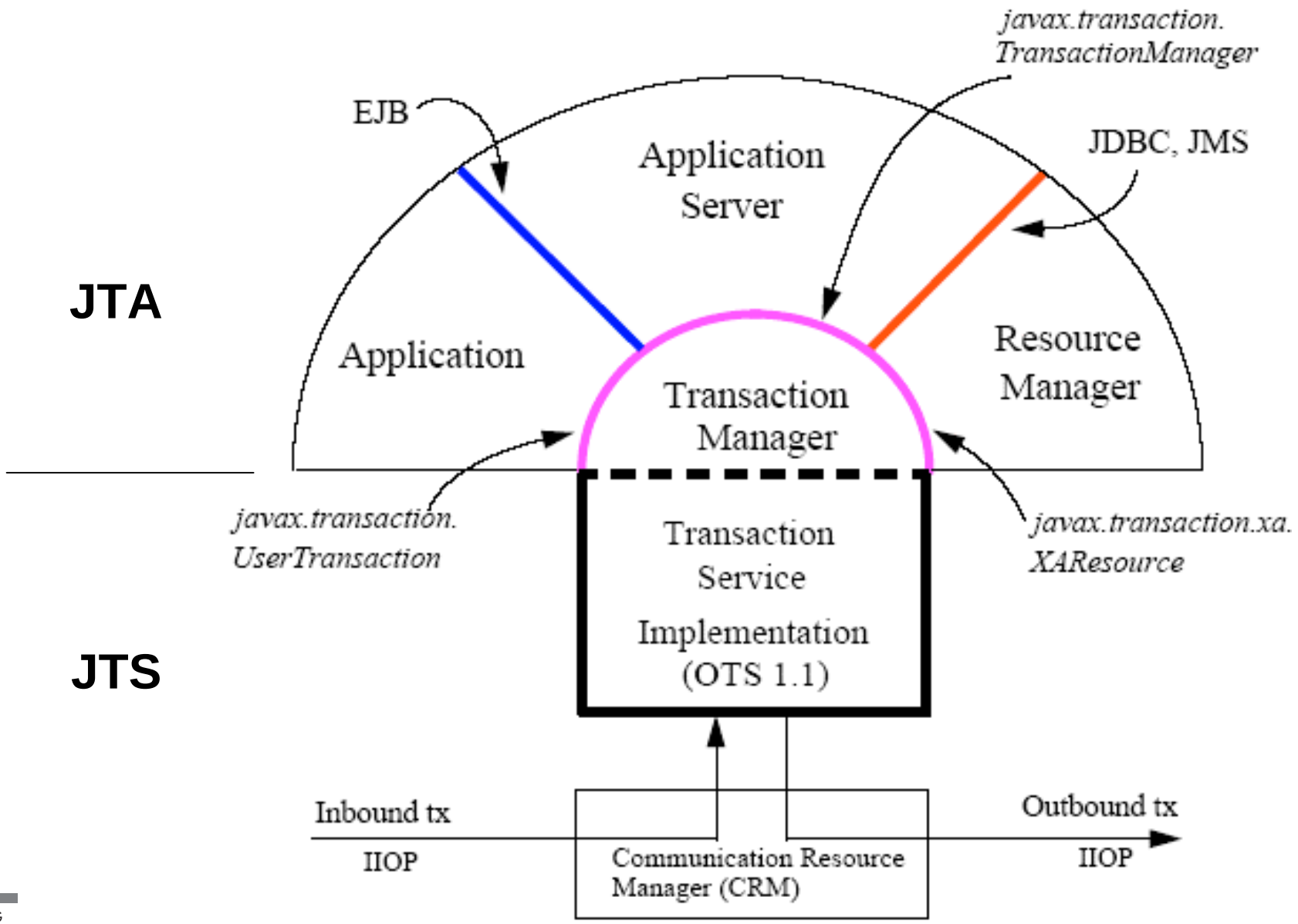
J2EE Technology



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JTA and JTS

JTA

javax.transaction.UserTransaction

- explicit in code
- implicit in EJB container

JTS

javax.transaction.TransactionManager

javax.transaction.xa.XAResource

handled by J2EE server and EIS resource managers

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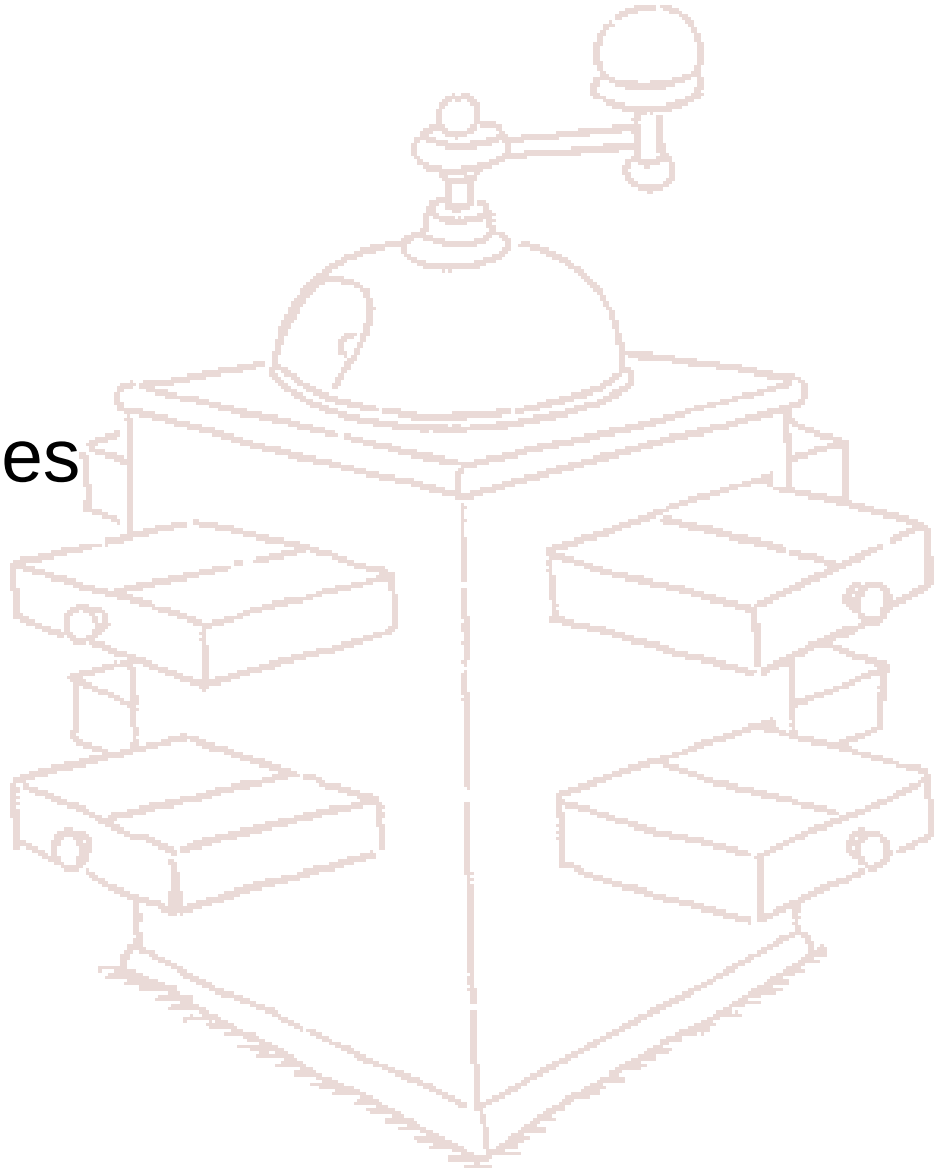
J2EE Tiers

- Client tier
- Web tier
- EJB tier
- EIS tier
- Web services



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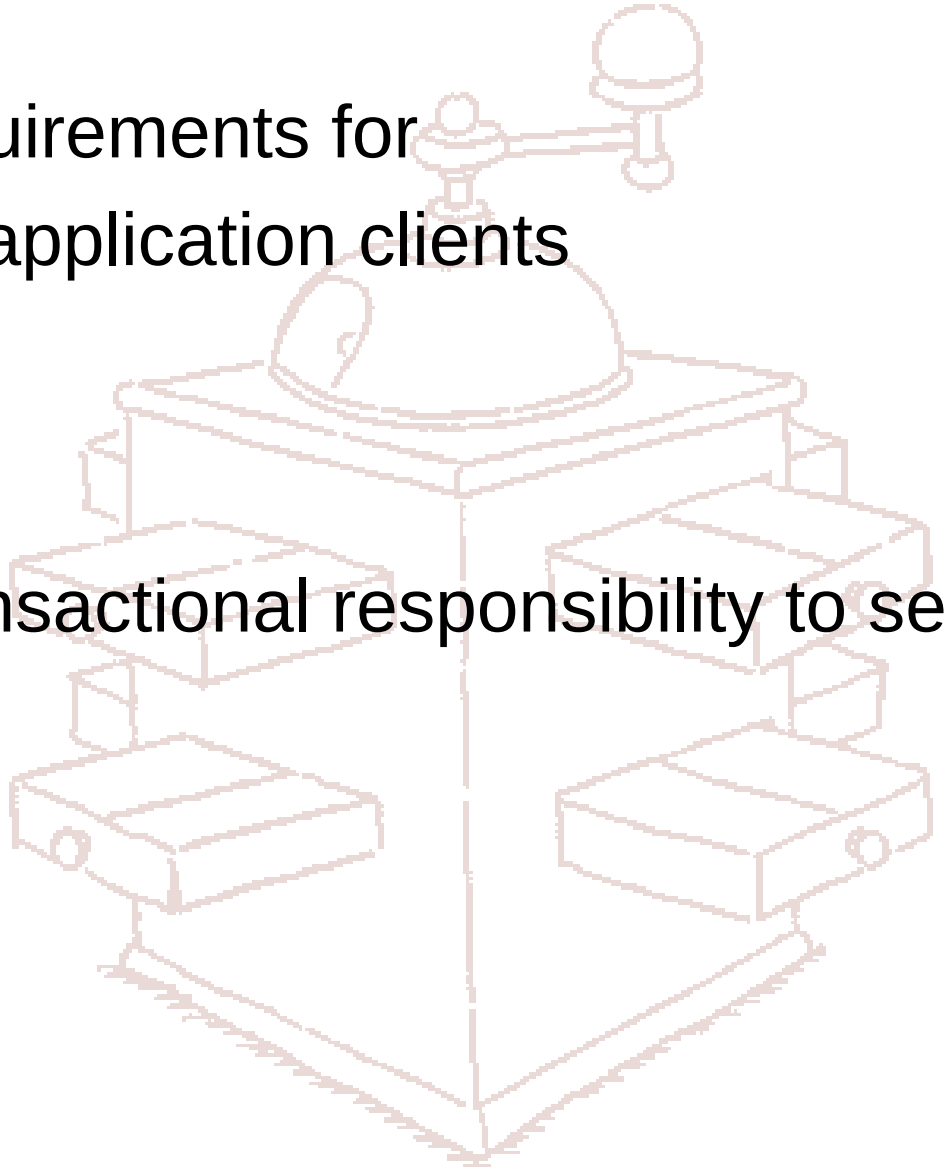
J2EE Client Tier

No J2EE requirements for

applets or application clients

Advise:

delegate transactional responsibility to server tiers



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J2EE Web Tier

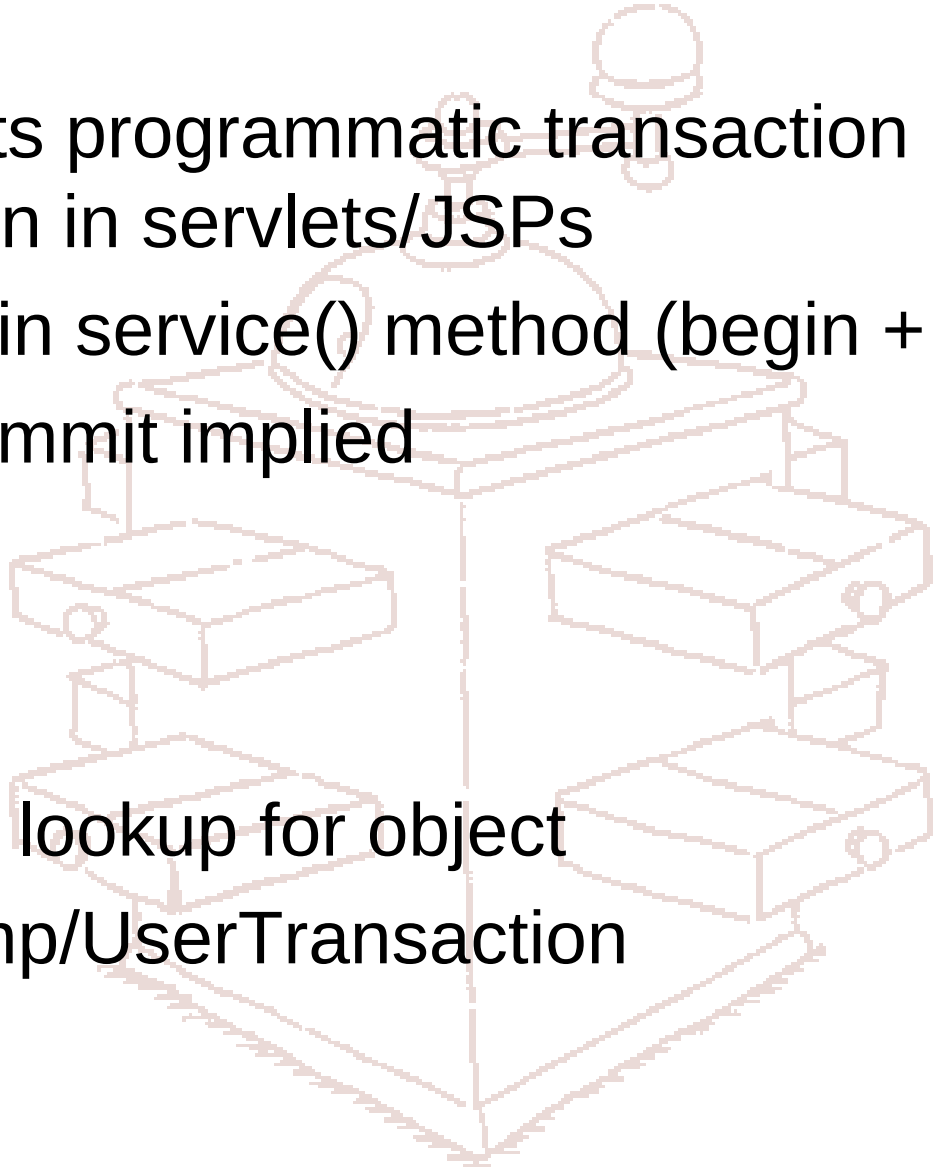
J2EE supports programmatic transaction demarcation in servlets/JSPs

- implement in service() method (begin + commit)
- 2 phase commit implied

Advise:

Use JNDI to lookup for object

- java:comp/UserTransaction



Start new transaction context

```
public void service(HttpServletRequest req,
          HttpServletResponse resp)
throws ServletException, IOException {

Context ctx = new InitialContext();
UserTransaction userTrx =
  (UserTransaction)
    ctx.lookup("java:comp/UserTransaction");

  userTrx.begin();

  // user code for accessing resources

  userTrx.commit();
}
```

J2EE EJB Tier

J2EE supports transaction demarcation

programmatic (**bean managed**)

- Session beans
  - **`afterBegin(), beforeCompletion(), afterCompletion()`**
- Message driven beans
  - **`onMessage()`**

UserTransaction

declarative (**container managed**)

- Session beans
- Entity beans

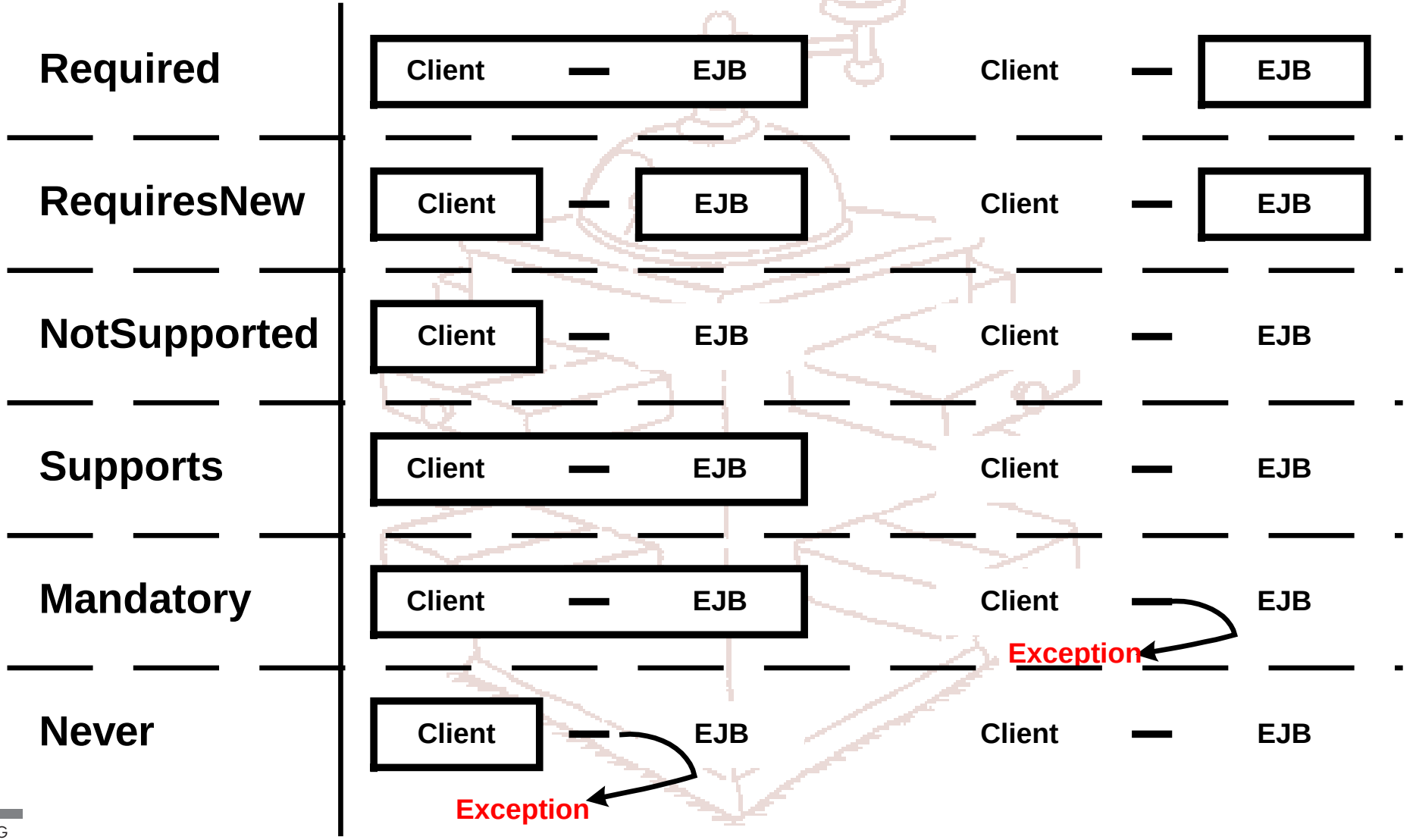
transaction attributes in deployment descriptor

Bean managed transaction

```
public void myMethod(…)throws RemoteException
{
 UserTransaction userTrx =
          ejbContext.getUserTransaction();
 try {
   userTrx.begin();
   // user code for accessing resources
   userTrx.commit();
 } catch (Exception e) {
    try {
      userTrx.rollback();
    } catch (SystemException se) { … }
 }
}
```

J2EE EJB Tier

Container managed transaction attributes



Container managed transaction descriptor

```
...
<container-transaction>
  <method>
      <ejb-name>PersonBean</ejb-name>
      <method-name>*</method-name>
  </method>
 <trans-attribute>Required</trans-attribute>
</container-transaction>
<container-transaction>
  <method>
      <ejb-name>CompanyBean</ejb-name>
      <method-name>updateInfo</method-name>
  </method>
 <trans-attribute>Mandatory</trans-attribute>
</container-transaction>
...
```

J2EE EJB Tier

Best practices XXX

	Required	Requires New	Not Support'd	Supports	Mandatory	Never
Session	XXX		EIS trx (*no J2EE support*)	NOT re-com-men-ded-		
Entity BMP	XXX					
Entity CMP		logging			get/set of CMP/CMR fields	
MDB	XXX		idem			

Depends on client

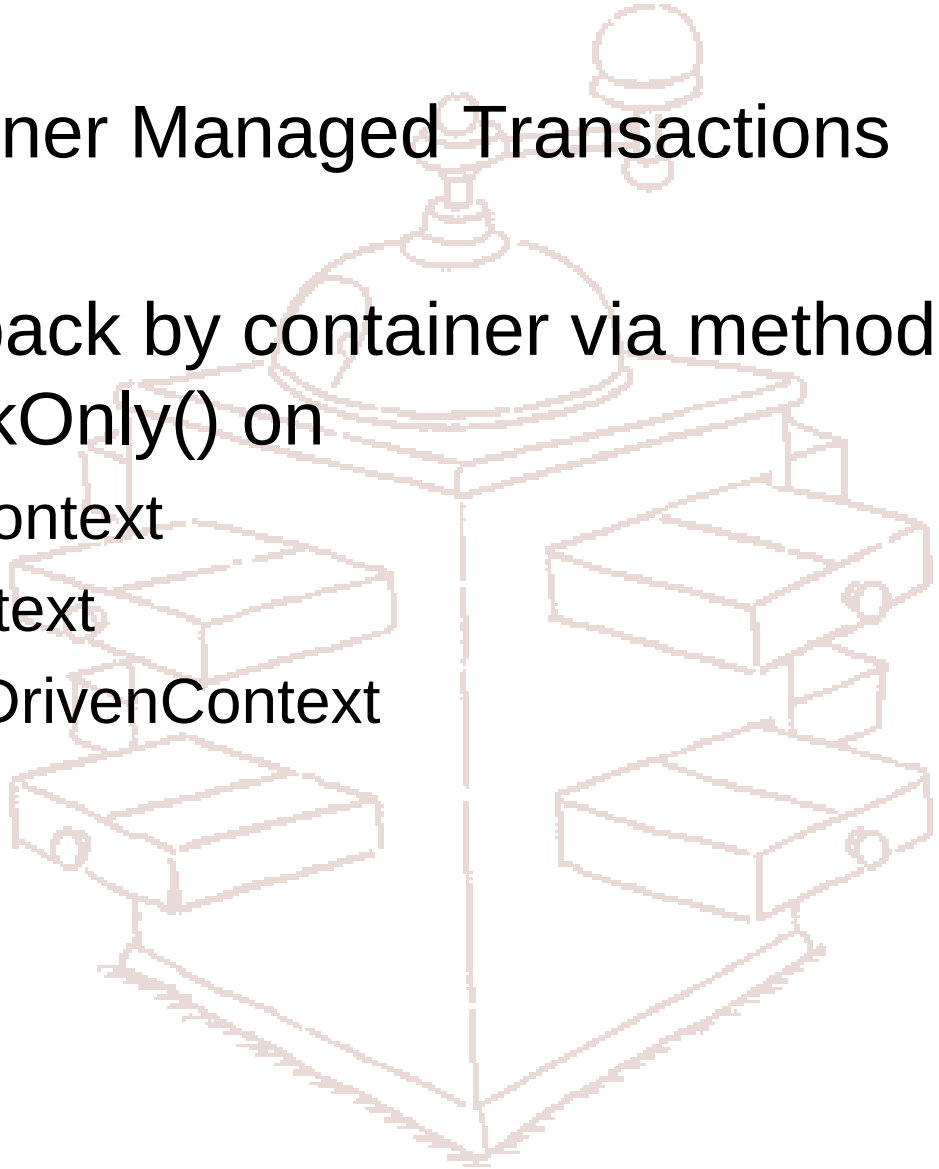
J2EE EJB Tier

Notes:

Use Container Managed Transactions preferably

trigger rollback by container via method setRollbackOnly() on

- SessionContext
- EntityContext
- MessageDrivenContext



J2EE EIS Tier

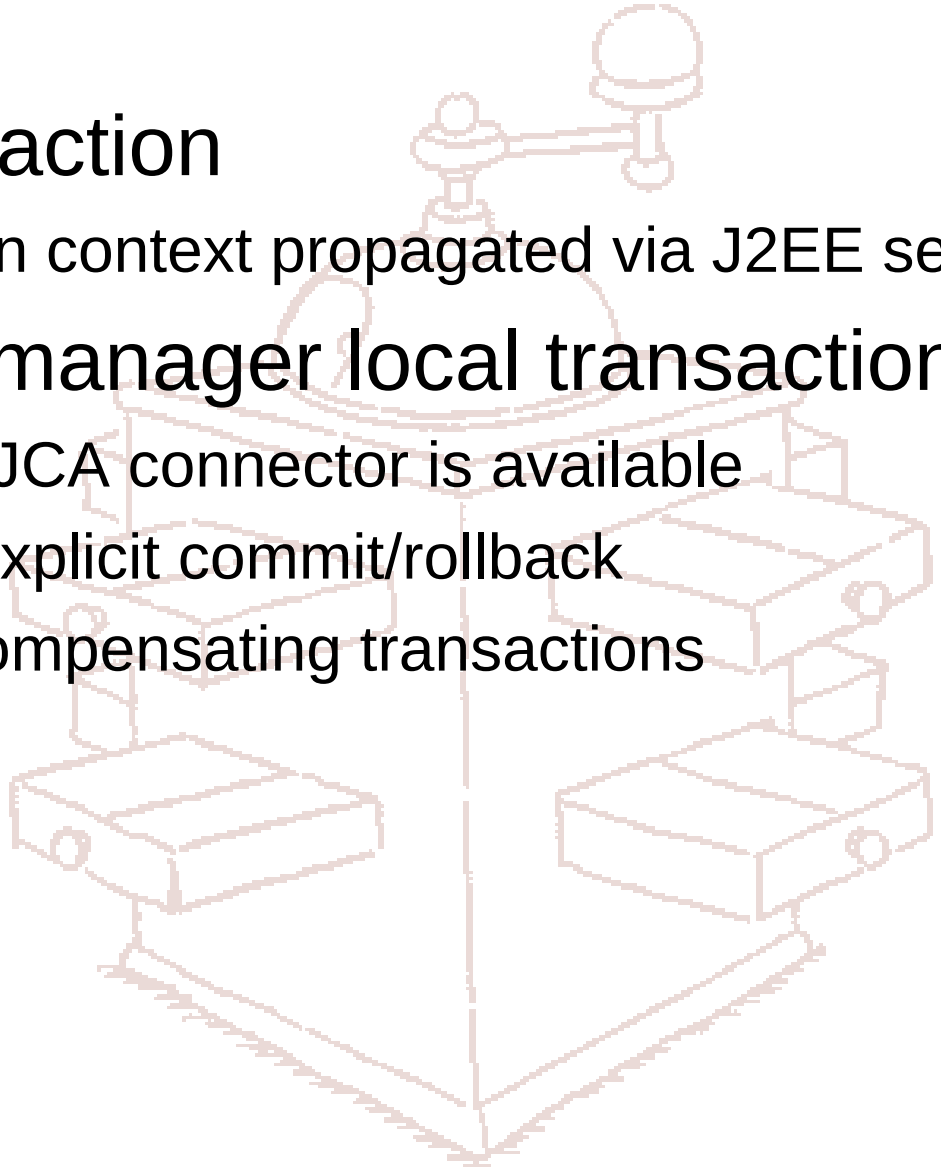
Access via

JTA transaction

- transaction context propagated via J2EE server

resource manager local transaction

- only if no JCA connector is available
- requires explicit commit/rollback
- provide compensating transactions



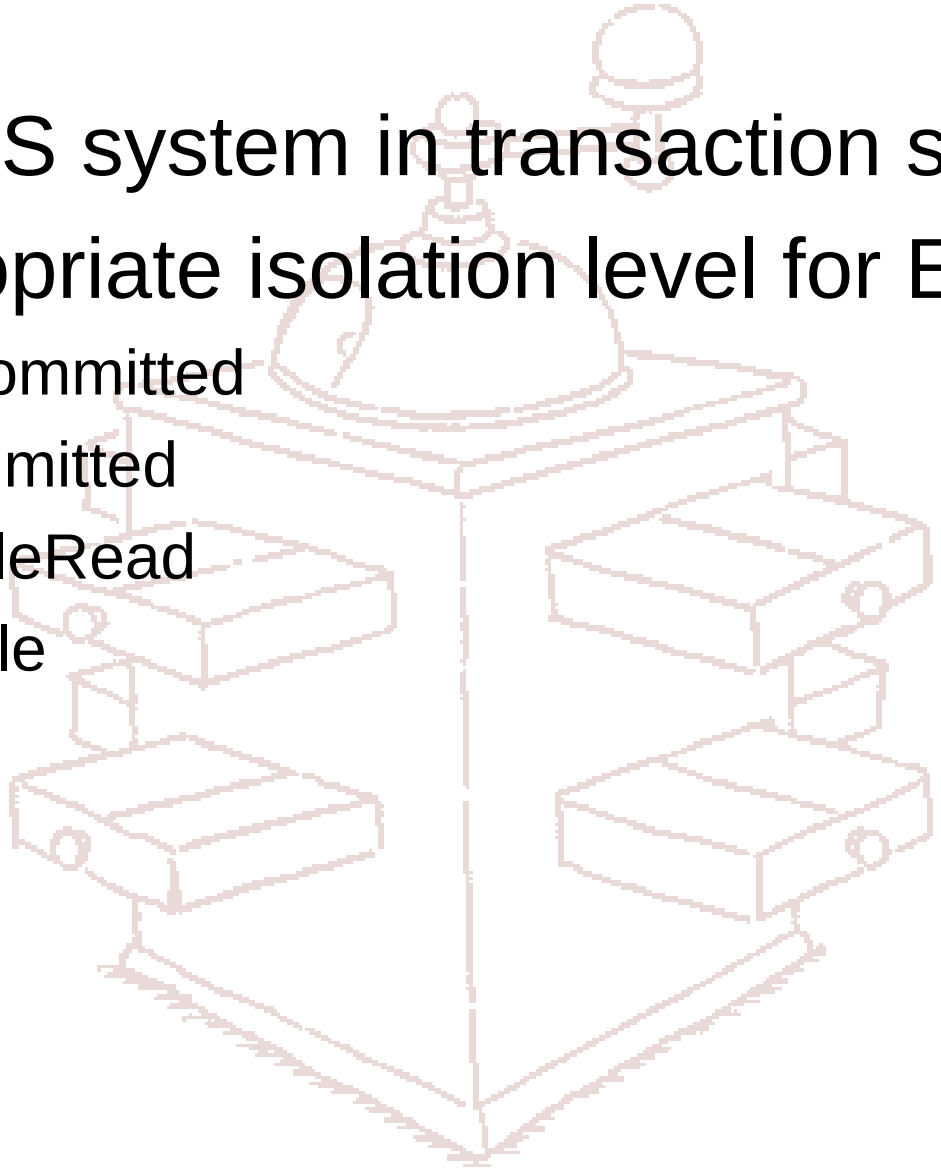
J2EE EIS Tier

Advise:

access EIS system in transaction scope

use appropriate isolation level for EIS

- ReadUncommitted
- ReadCommitted
- RepeatableRead
- Serializable



J2EE Resource Managers

JDBC – Java Data Base Connectivity

- J2EE defines access to 1 JDBC resource per trx

JCA – Java Connector Architecture

- integration with EIS via standard resource adapters
  - NoTransaction
  - LocalTransaction
  - **XATransaction**

JMS – Java Messaging Service

- J2EE supports at least 1 JMS provider per trx
- messages are delivered/consumed in UoW
- transactions are NEVER propagated between sender and receiver of message!

Transactions and J2EE Summary

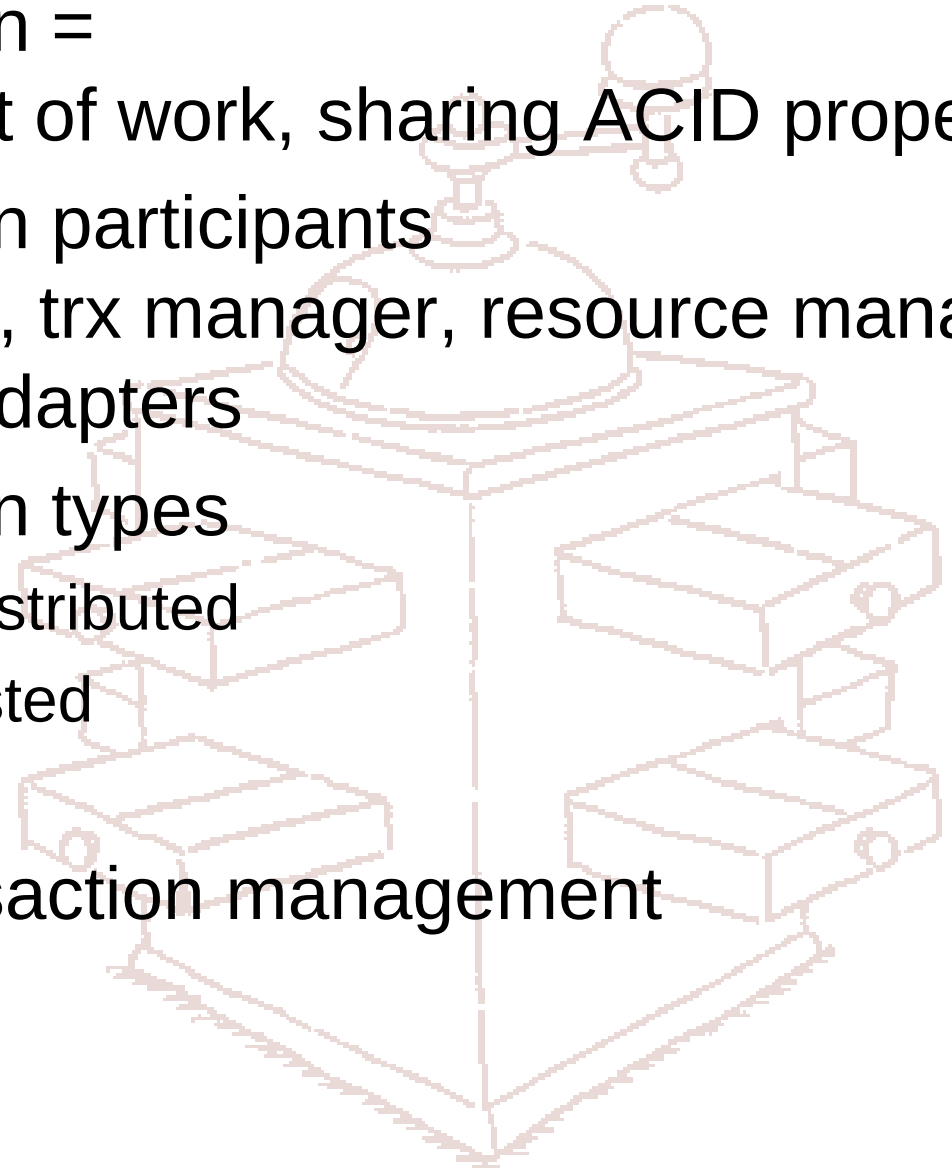
Transaction =
logical unit of work, sharing ACID properties

Transaction participants
application, trx manager, resource managers, resource adapters

Transaction types

- local or distributed
- flat or nested
- extended

J2EE transaction management



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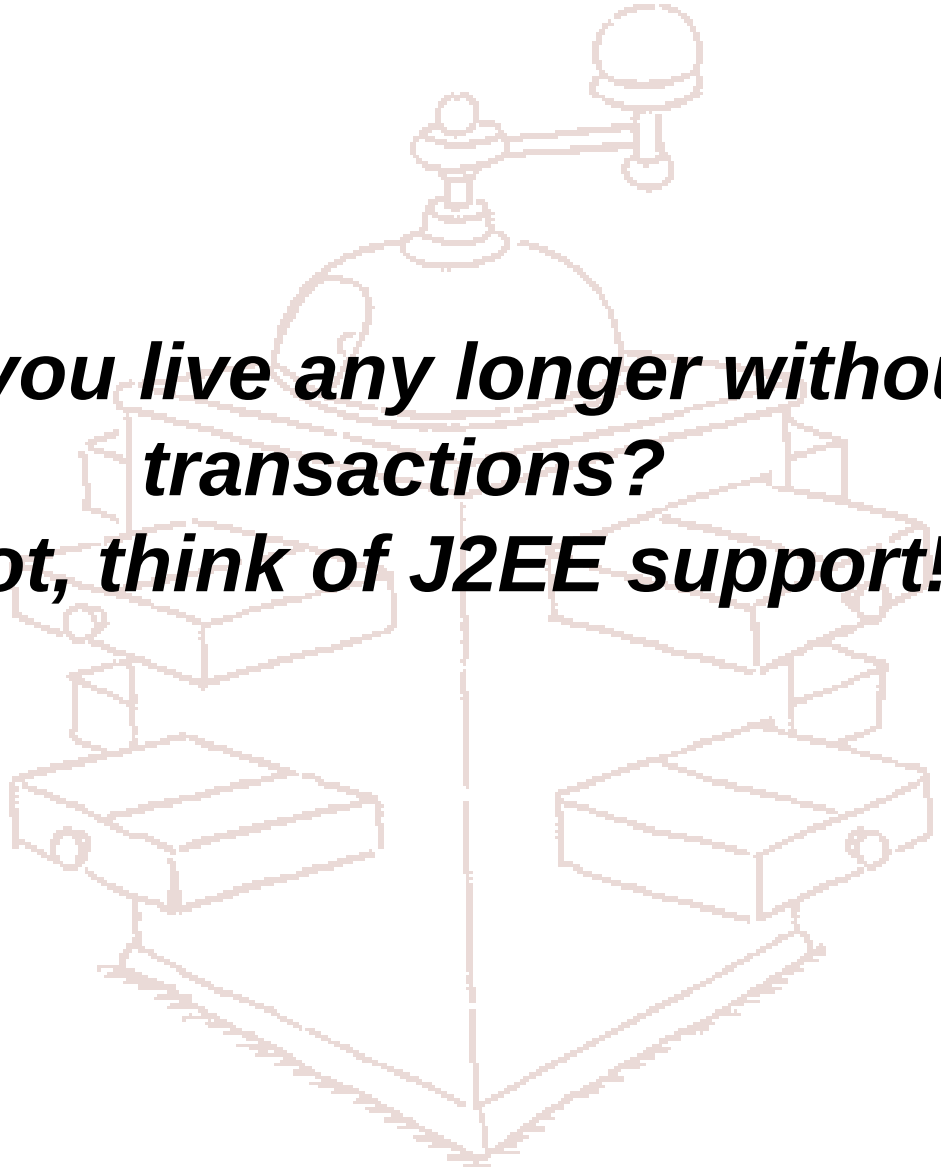
If You Only Remember One Thing...



Can you live any longer without transactions?
If not, think of J2EE support!

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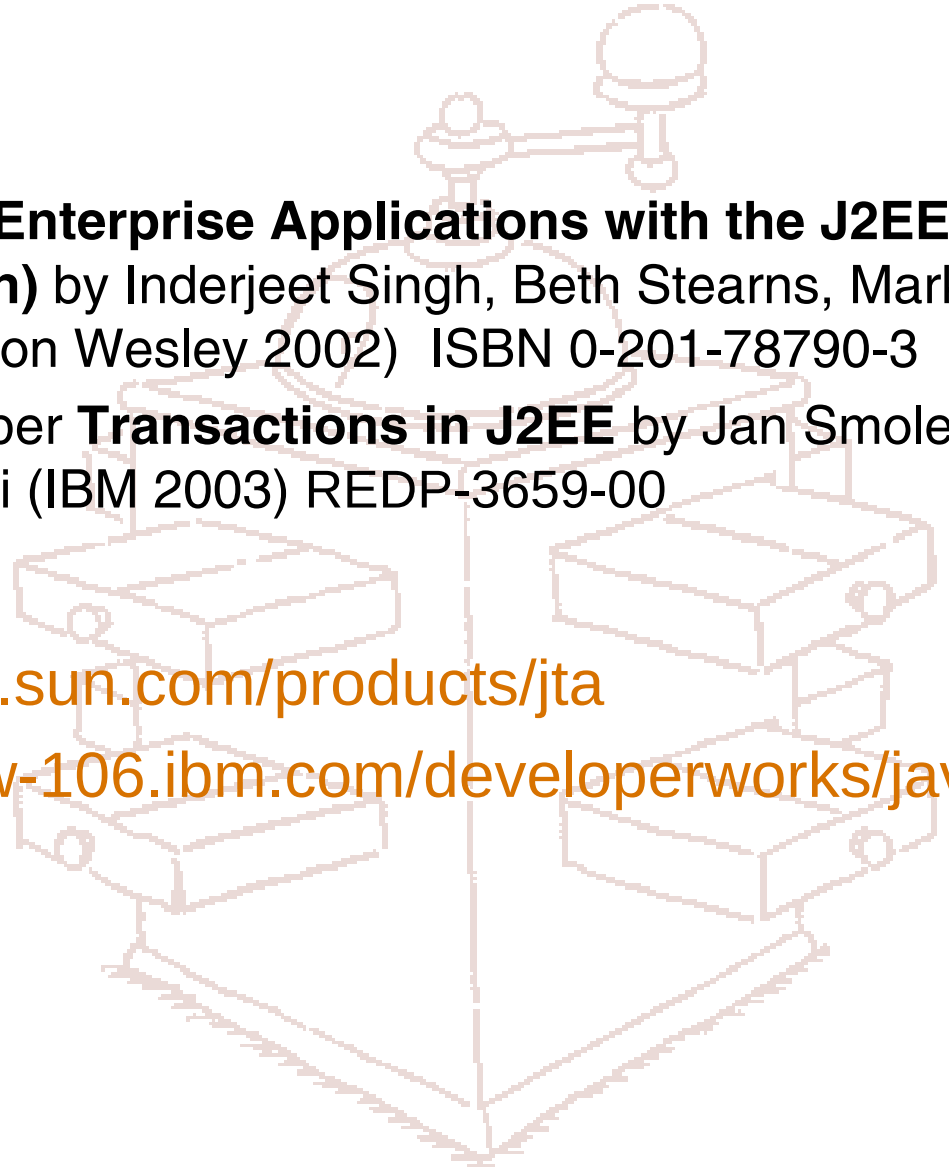
J2EE Transactions - References

Books

- **Designing Enterprise Applications with the J2EE platform (2nd edition)** by Inderjeet Singh, Beth Stearns, Mark Johnson et al. (Addison Wesley 2002) ISBN 0-201-78790-3
- IBM Redpaper **Transactions in J2EE** by Jan Smolenski and Peter Kovari (IBM 2003) REDP-3659-00

URLs

- http://java.sun.com/products/jta
- http://www-106.ibm.com/developerworks/java/



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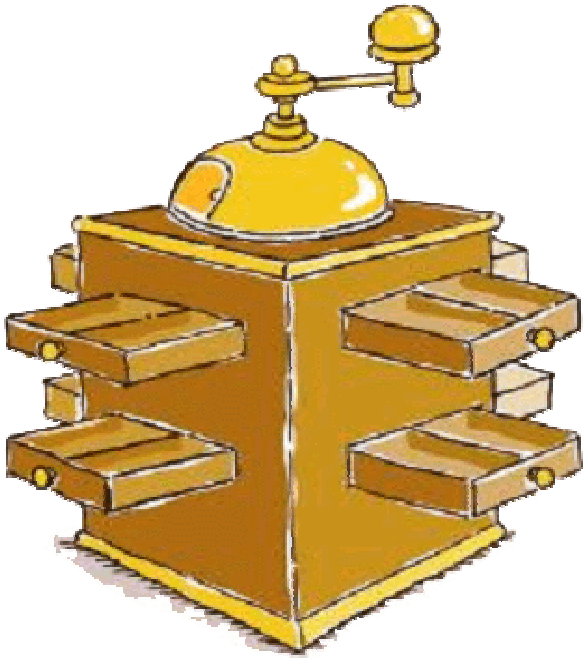

Q & A

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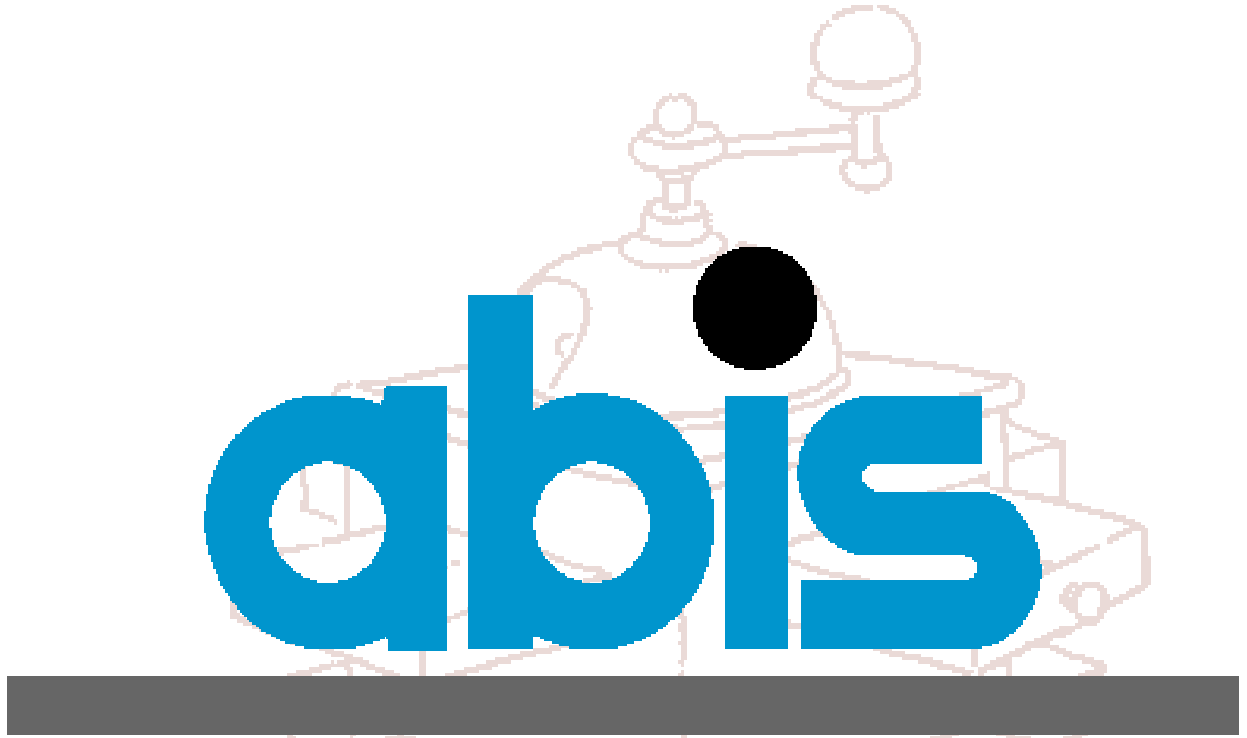

thanks you