Transactions and J2EE

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Answer to Your Questions

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

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  - Database consolidation
  - Reuse & integration

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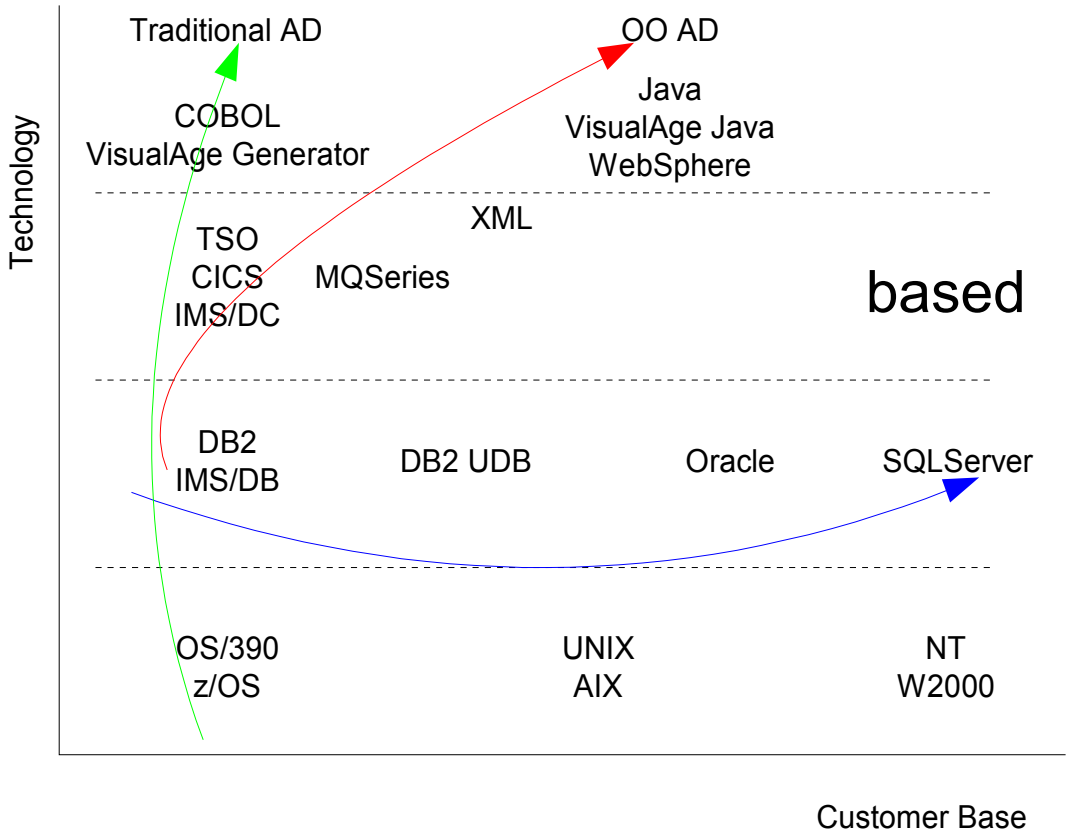

Agenda

- **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."*

Transaction: Glossary

Transaction properties

- **A** tomicity
- **C** onsistency
- **I** solation
- **D** urability

Transaction demarcation/boundaries

- Commit
- Rollback

Agenda

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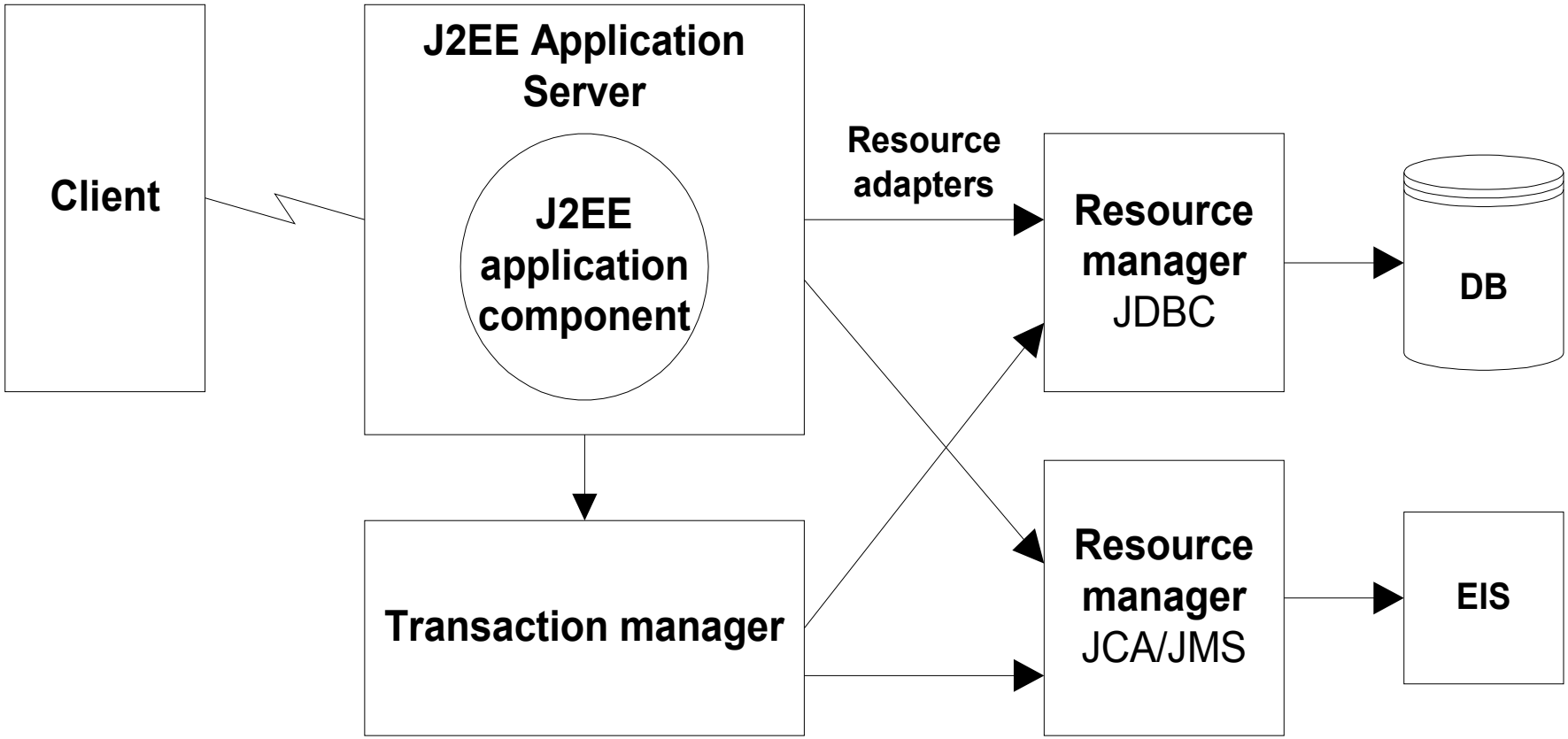
- **Transaction participants**
- Transaction types
- J2EE transactions
- Q & A

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

Transaction Participants



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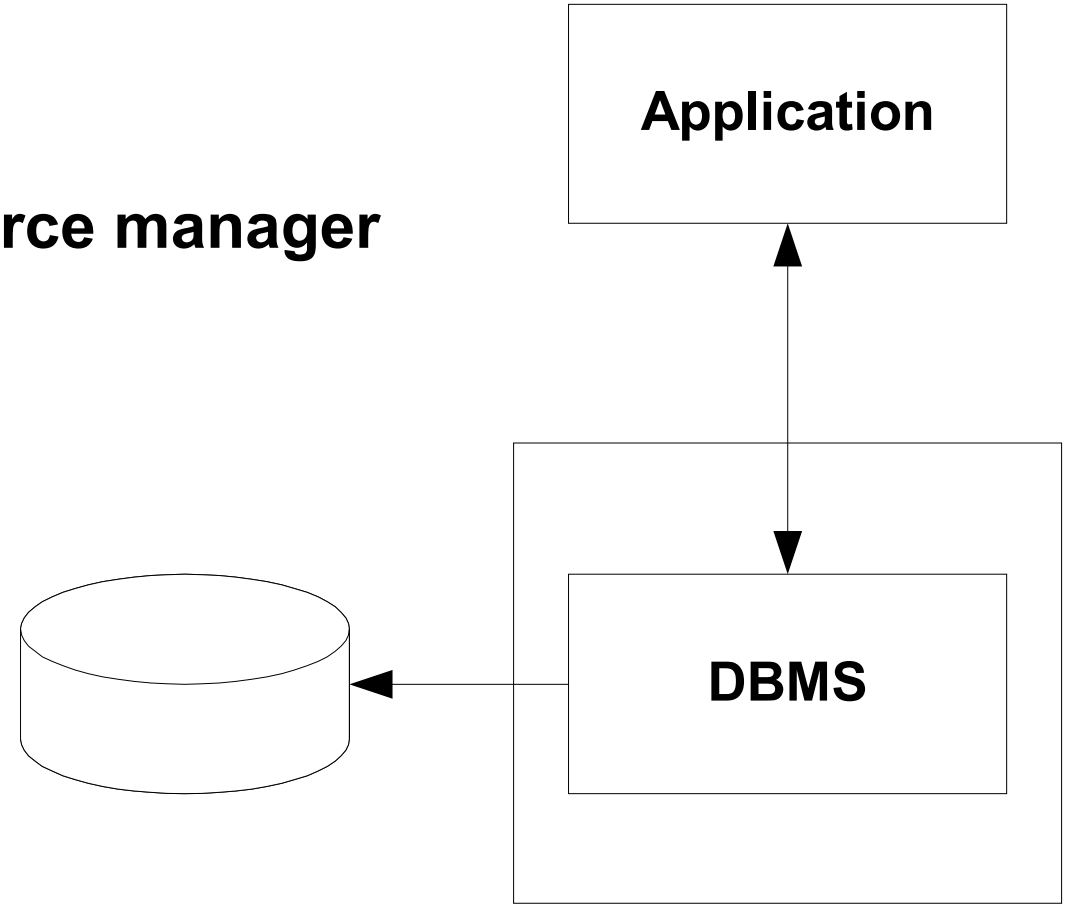
Transaction Types

- 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

Local Transaction

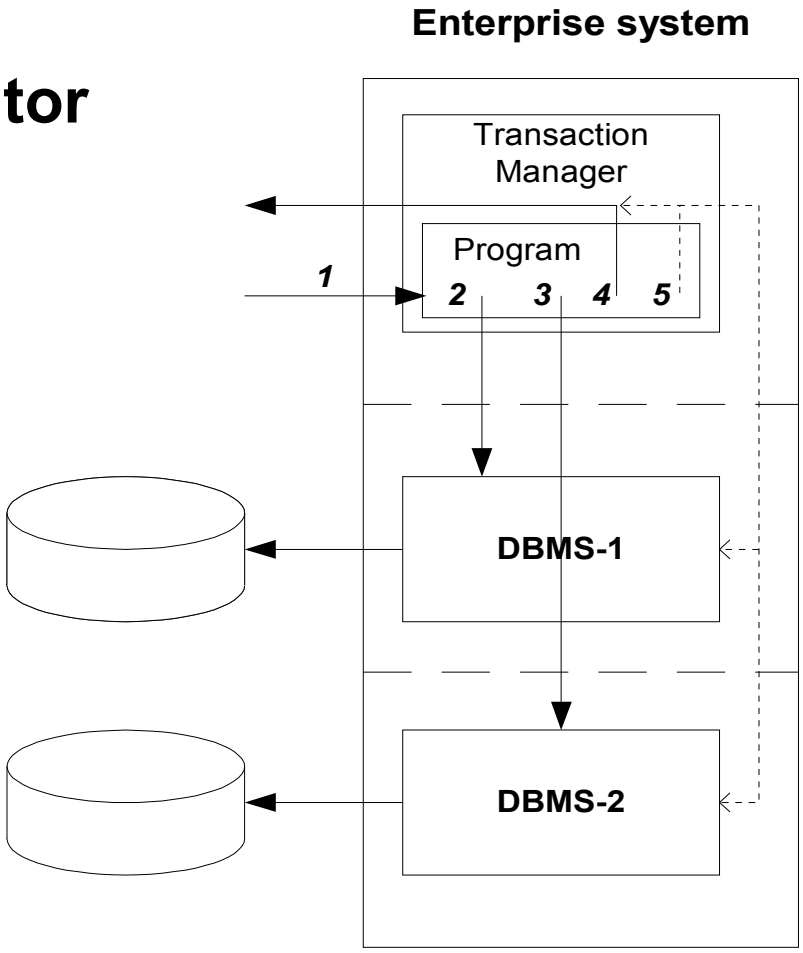
1 resource manager



Traditional Transaction Manager

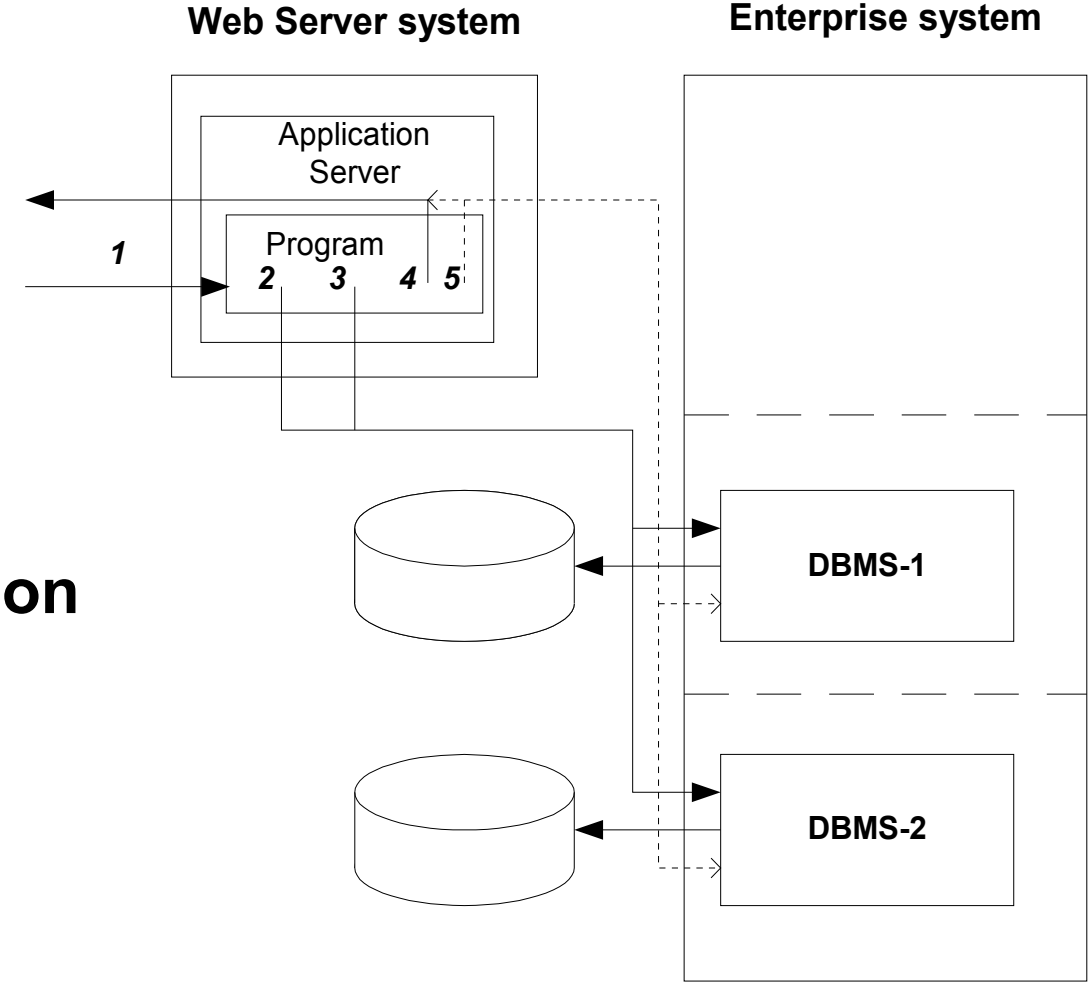
TeleProcessing monitor

+ multiple resource managers



Application Server As Trx Manager

J2EE application server



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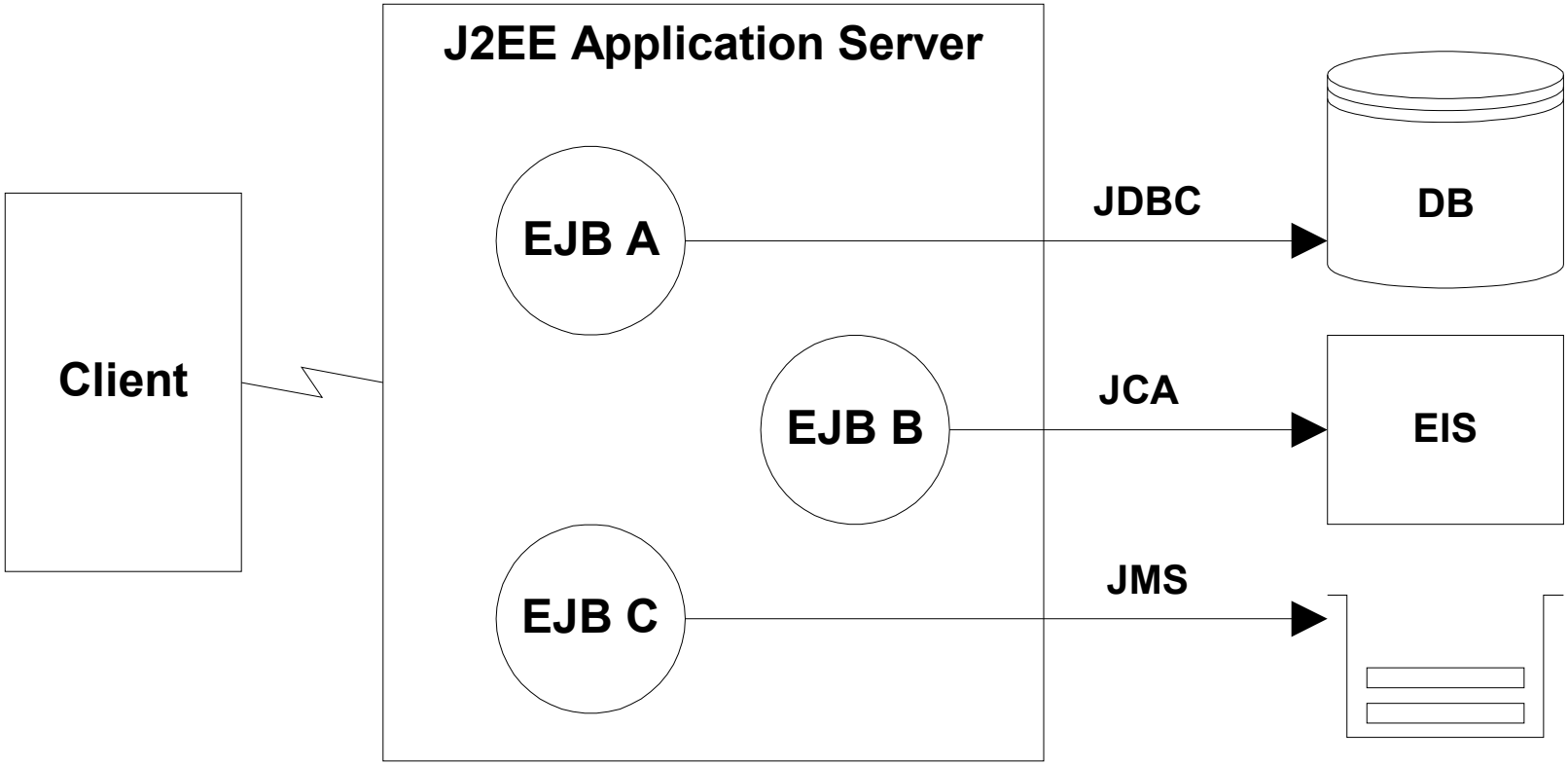
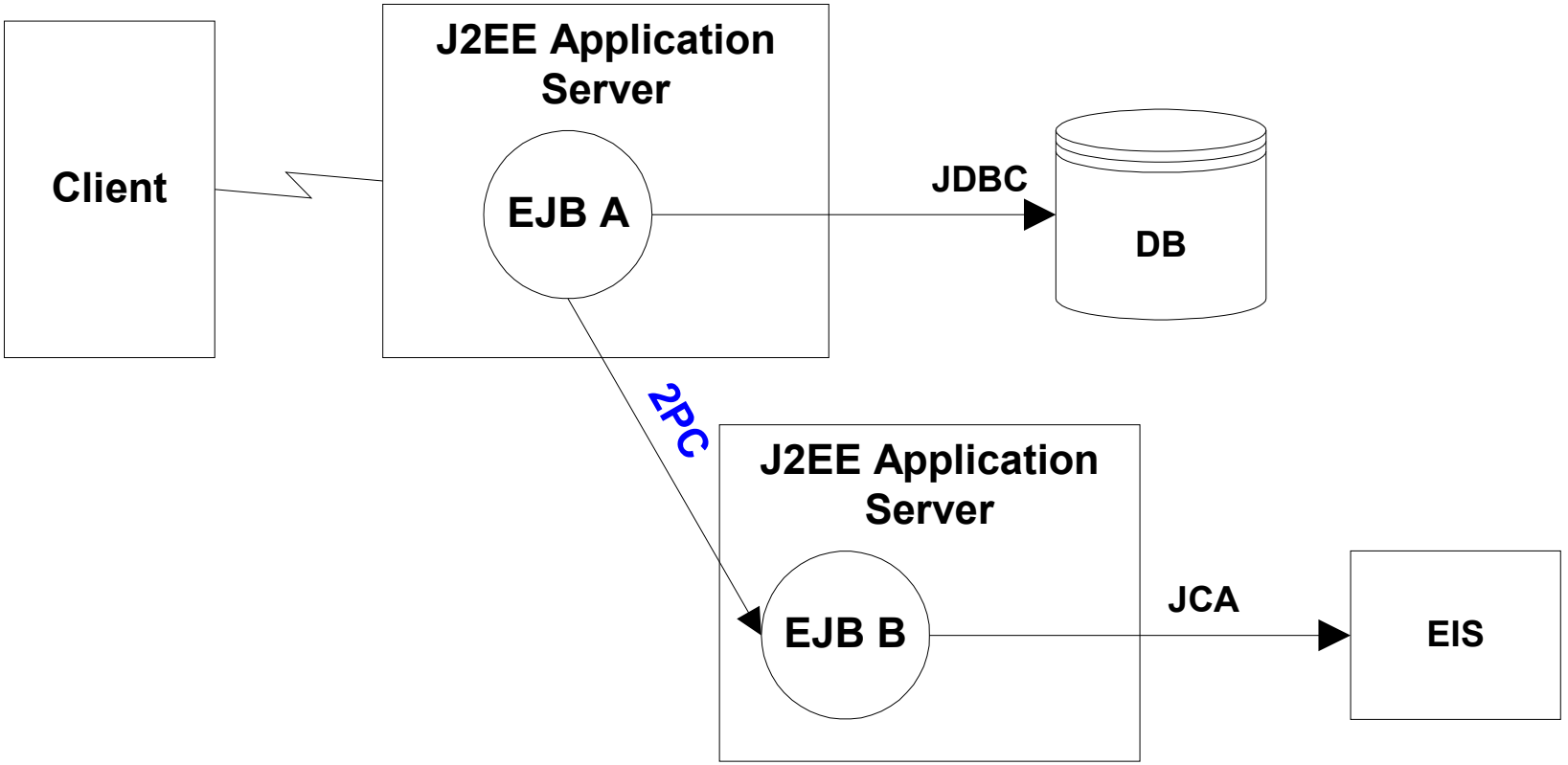
Distributed Transaction

Multiple resource managers



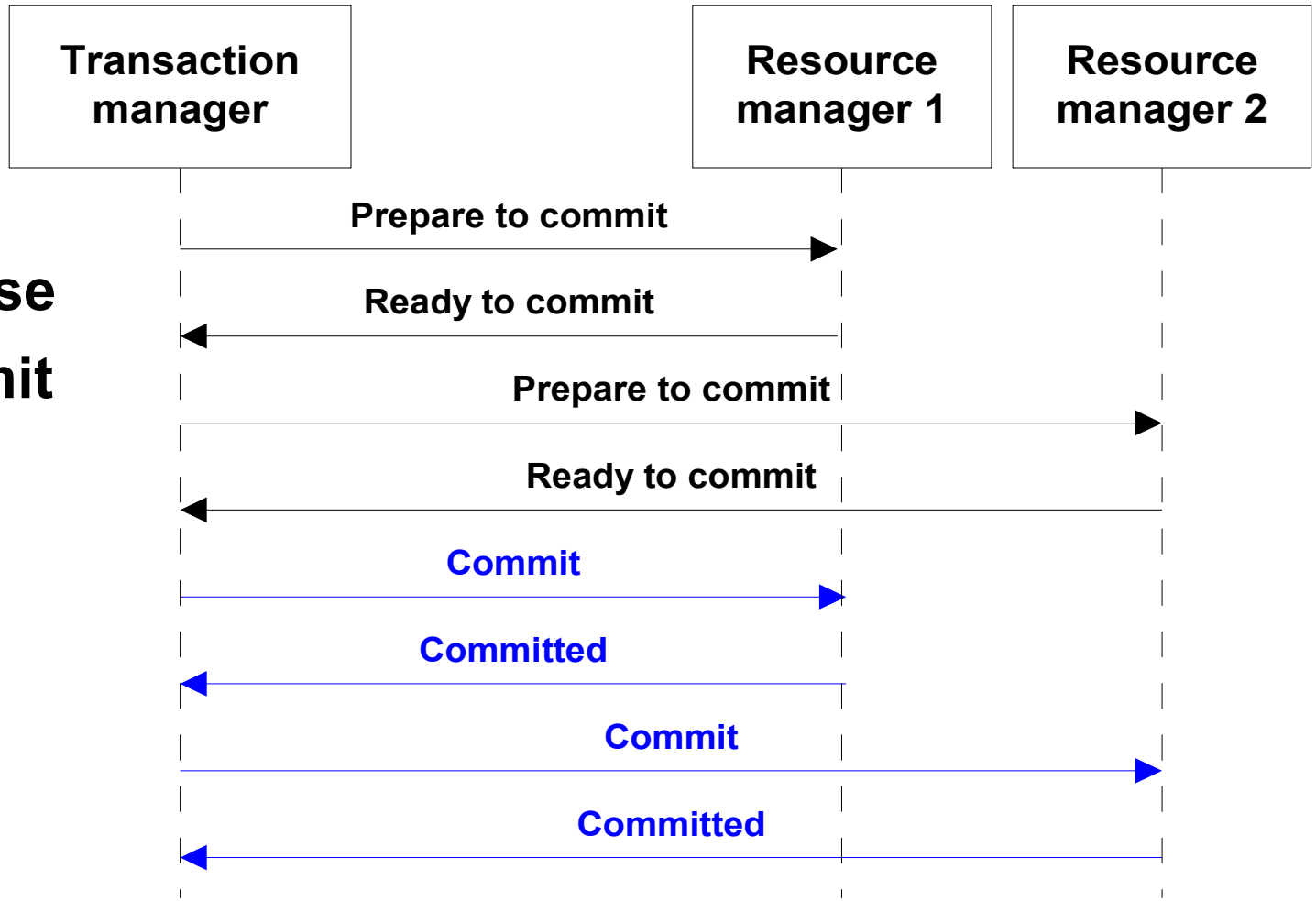
Distributed Transaction

Multiple transaction managers



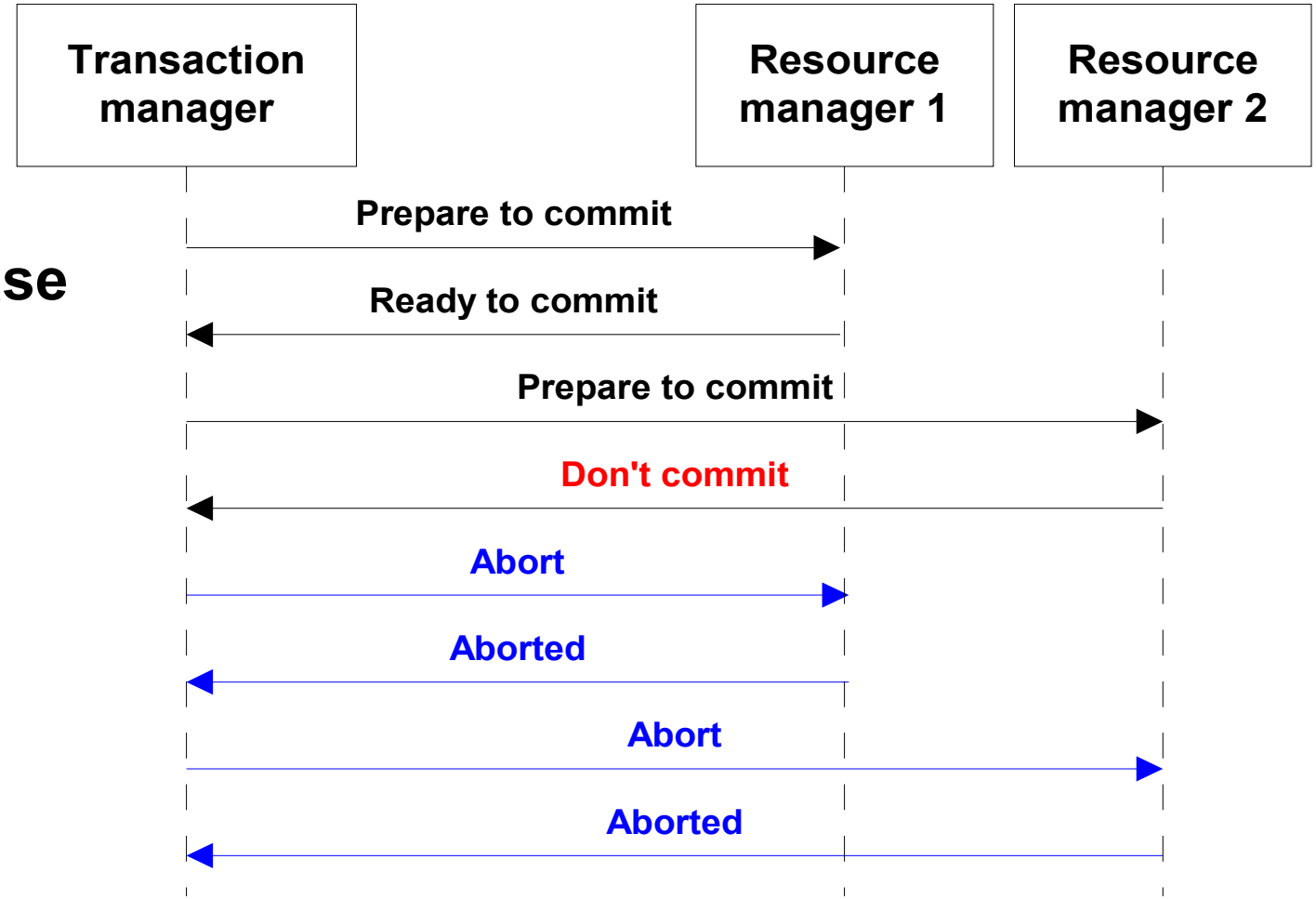
Distributed Transaction

2 Phase Commit



Distributed Transaction

2 Phase abort



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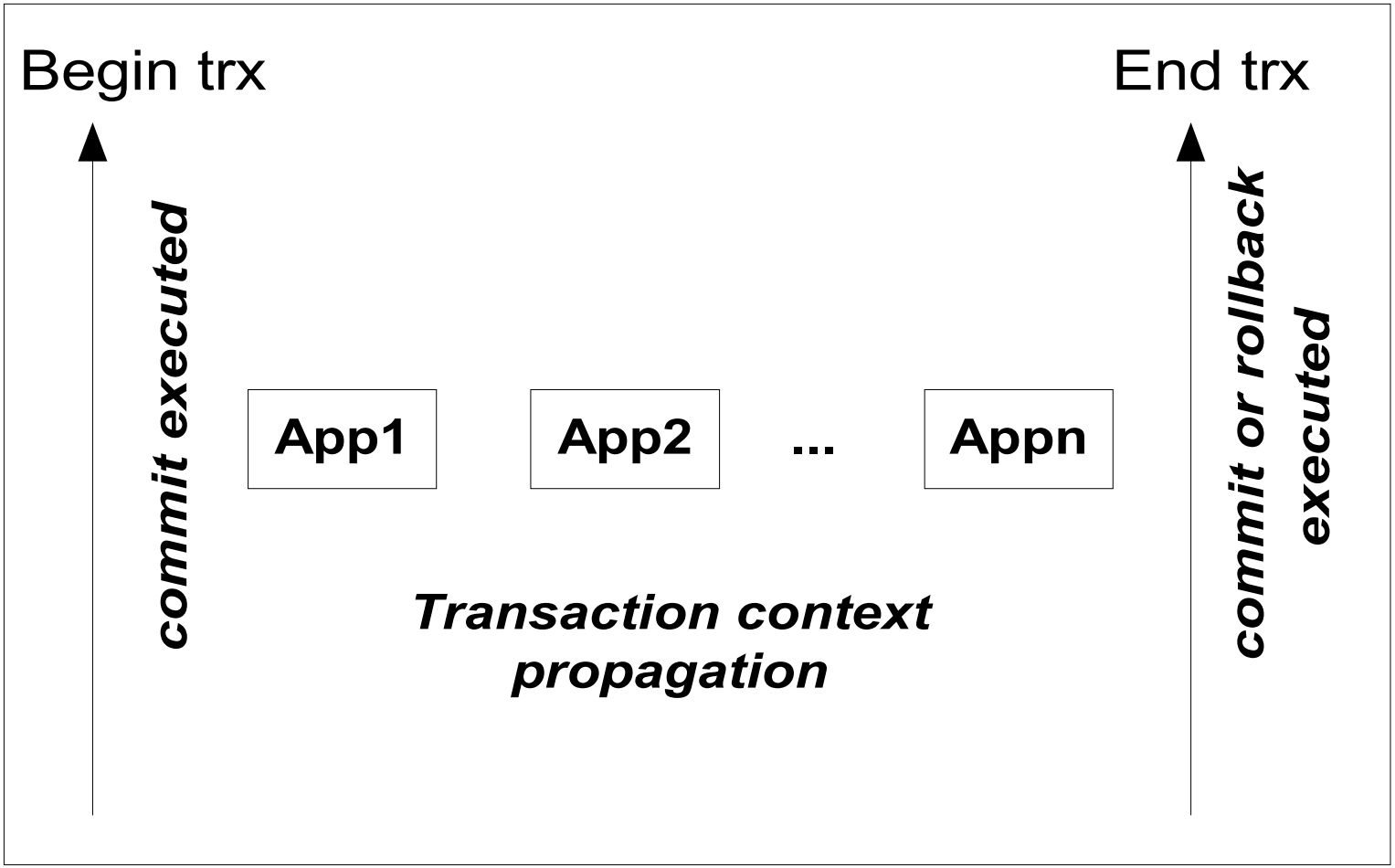
Flat Transaction



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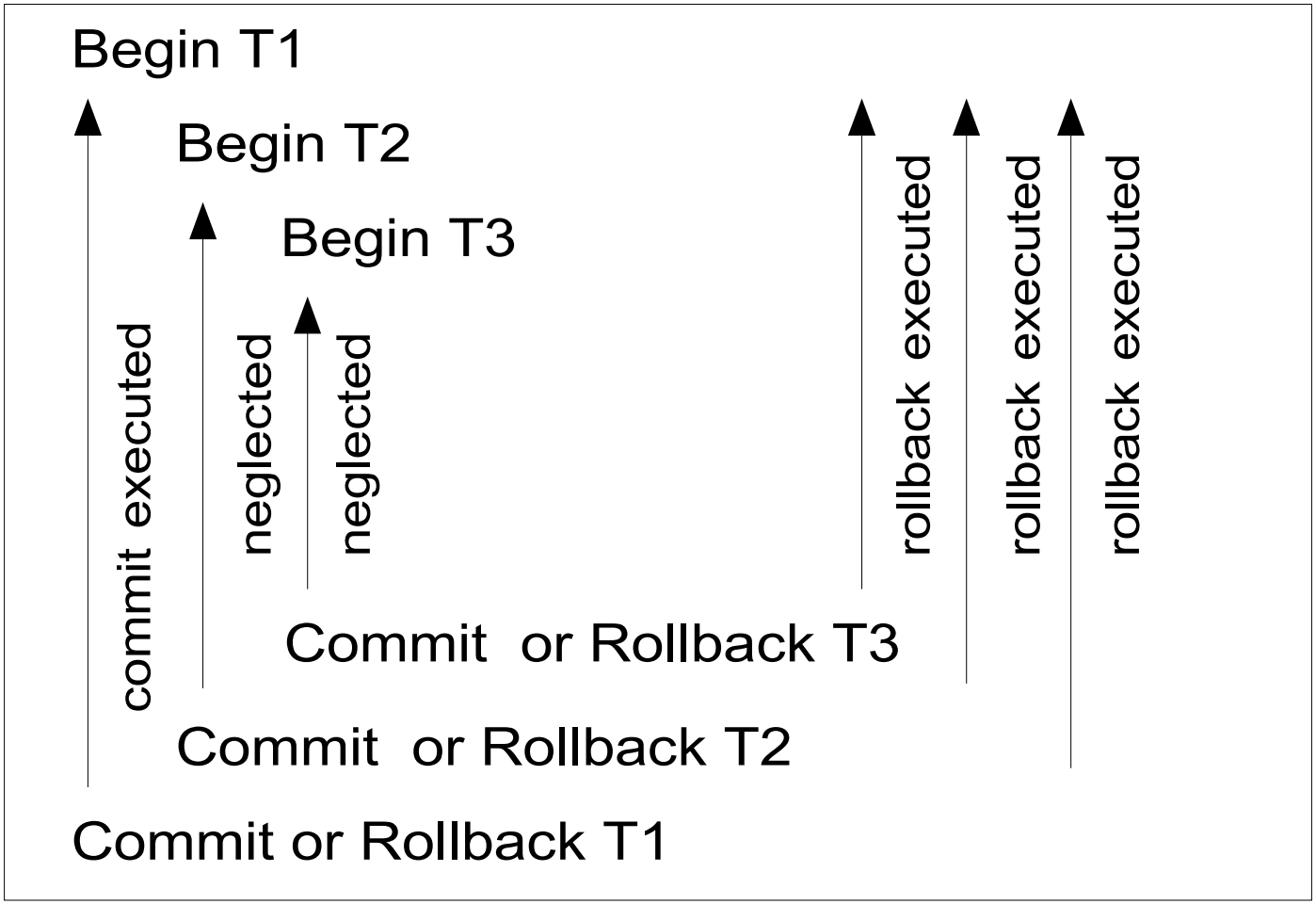
Nested Transaction



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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();
}
```

Extended Transaction

- Long lived
- Message oriented
- Web services
  - Business Transaction Protocol (OASIS) – JSR-156
  - WS-Transaction, WS-Coordination
  - Activity Service (OMG) – JSR-95

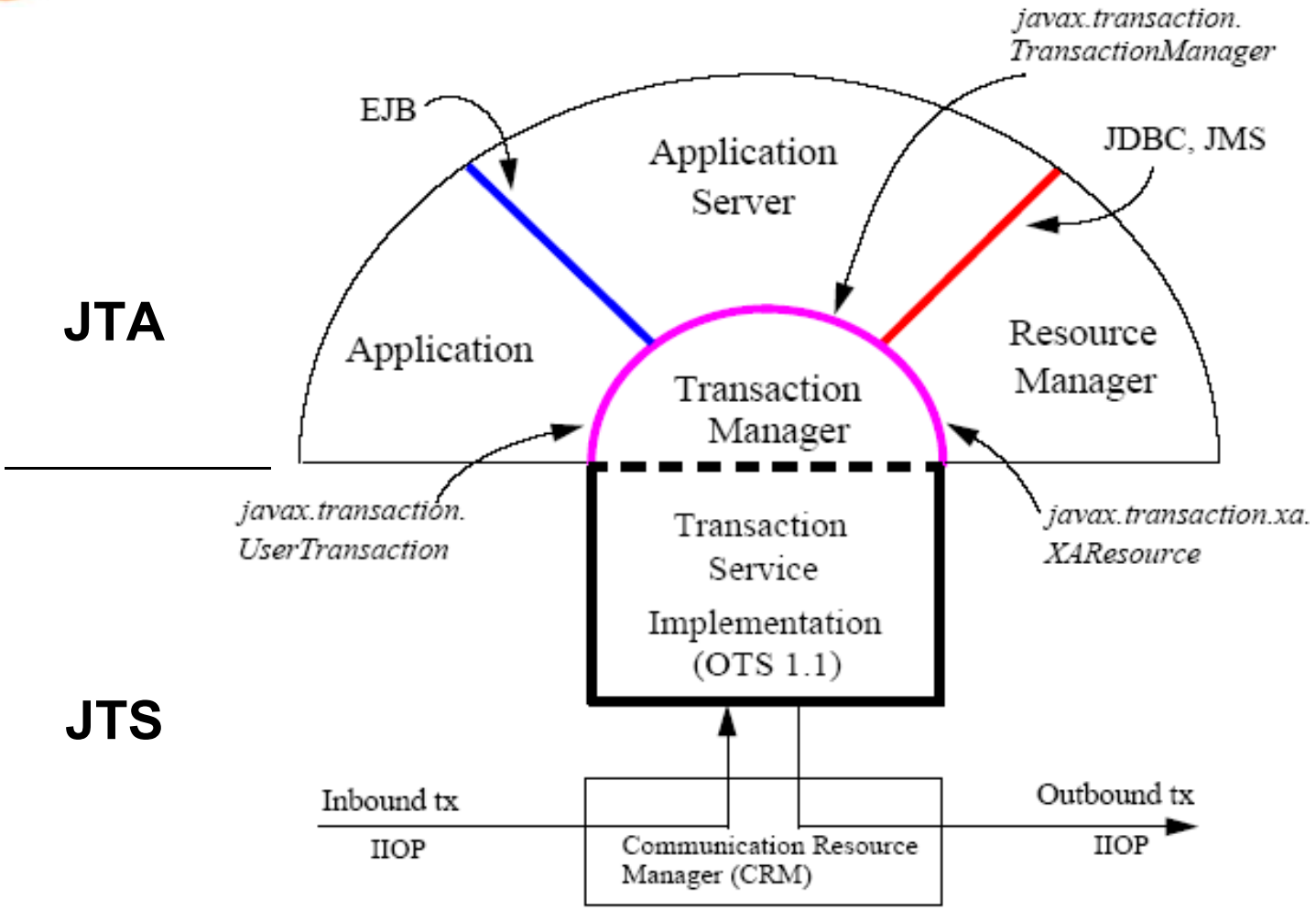
Agenda

- Transaction: definition and glossary
- Transaction participants
- Transaction types
- **J2EE transactions**
- Q & A

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

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

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

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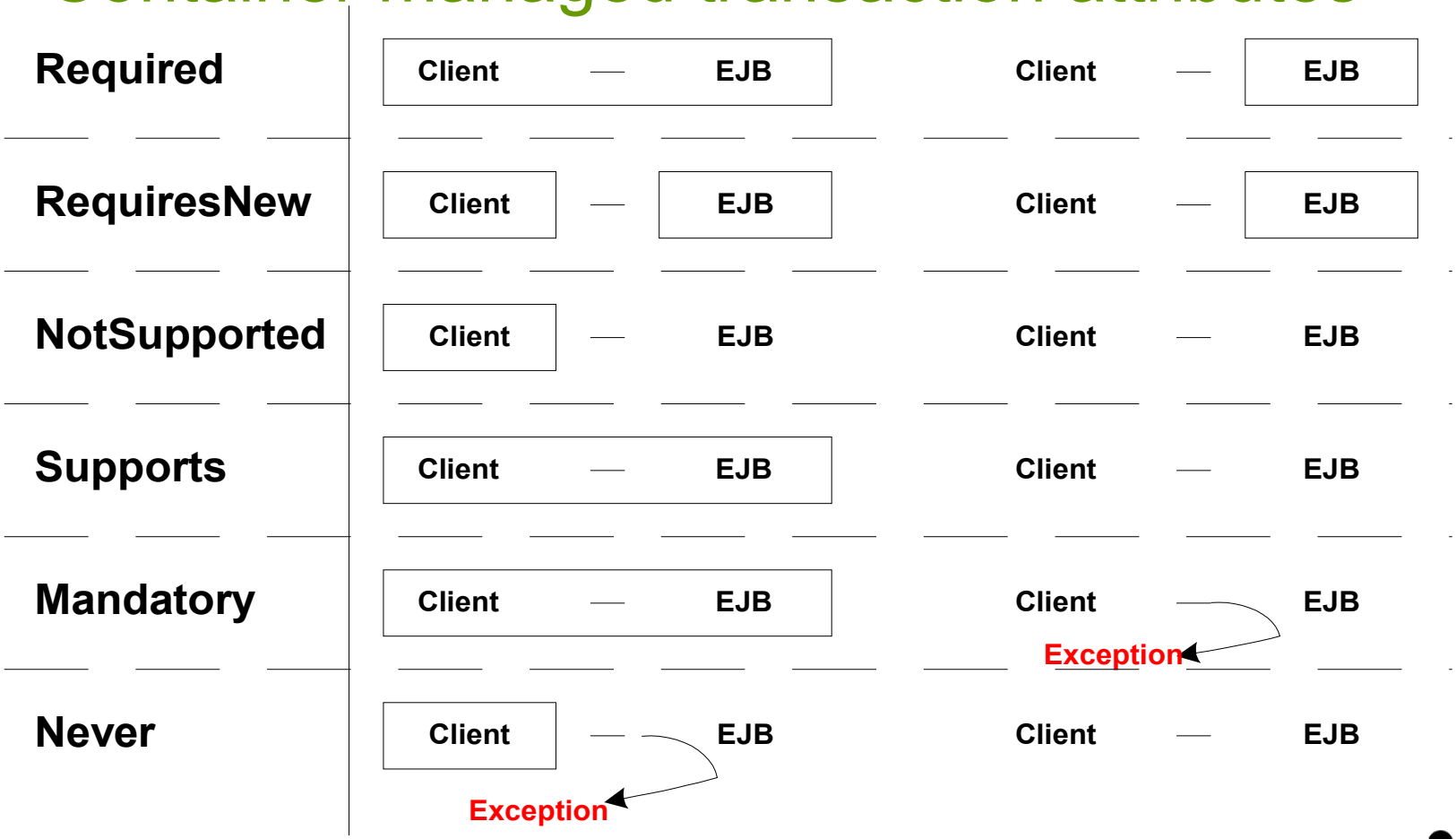
Bean managed transaction

```
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



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J2EE EJB Tier

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>
...
```


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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

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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

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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!

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

If You Only Remember One Thing…

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

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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thanks you