

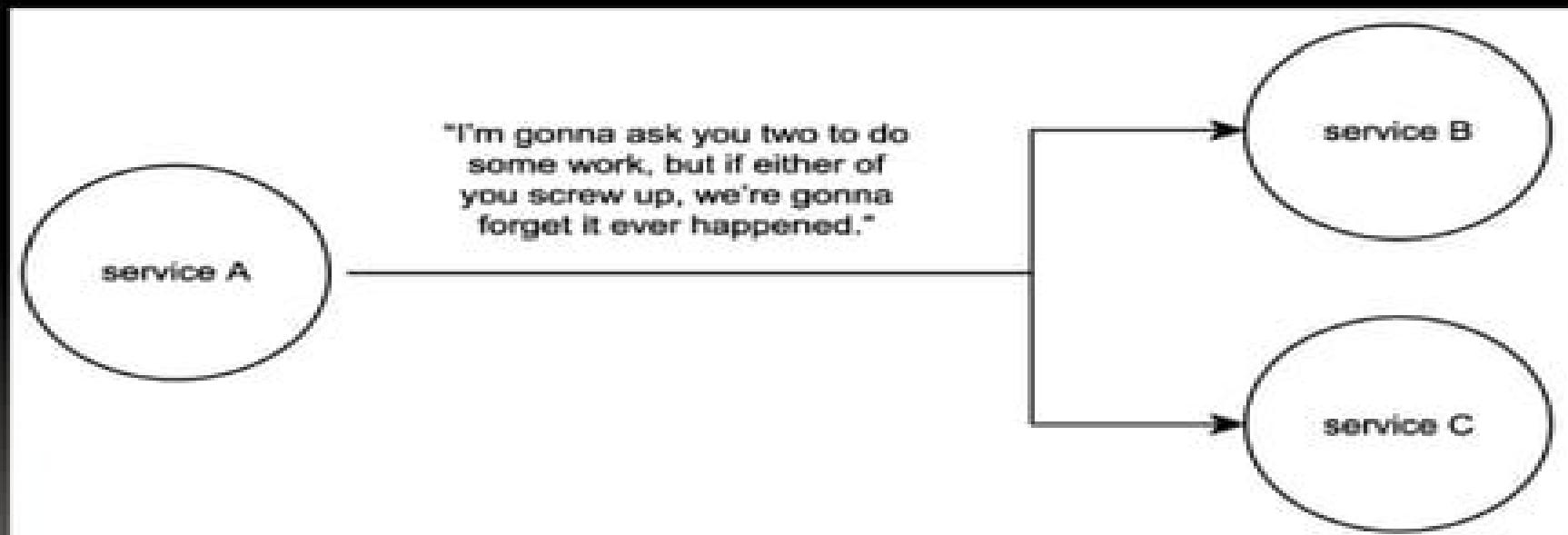
# Atomic Transactions and Business Activity

# WEB SERVICES AND CONTEMPORARY SOA

## (PART I: ACTIVITY MANAGEMENT AND COMPOSITION)

### Atomic transactions

- When managing certain types of corporate data, the need to wrap a series of changes into a single action is fundamental to many business process requirements.
- Atomic transactions implement the familiar commit and rollback features to enable cross-service transaction support



Atomic transactions apply an all-or-nothing requirement to work performed as part of an activity

# WEB SERVICES AND CONTEMPORARY SOA

## (PART I: ACTIVITY MANAGEMENT AND COMPOSITION)

### In Plain English

While we were washing my car, a neighbor stops by and offers us some money to wash his car. Having nothing else planned for the afternoon, we oblige and apply the same car washing process to the neighbor's car.

In the following weeks, word of our car washing abilities gets around, and others from the neighborhood start requesting our services. We soon find ourselves washing four or five cars every weekend.

We then come across a car with a special metallic finish. Not knowing any better, we proceed to apply our standard car washing process. When the car dries, though, we notice spots of discoloration throughout its exterior. A subsequent investigation leads us to find out that the soap we've been using is not suitable for some finishes (including metallic paint).

This turns into an expensive lesson, as we subsequently fund a new paint job. To prevent this from happening again, we decide to take measures. We proceed to purchase some specialized soaps for use in our water. The choice of soap is dependent on the finish of the car we are washing.

Sometimes the use of these new soaps requires us to carefully mix two or more cleaning solutions together. We determine a correct mixture by assessing the resulting color of the water. However, because we tend to eyeball this process, it can sometimes go wrong. We agree that if the correct color is not attained, we empty the contents of the bucket and start again.

This change to our process affects the following two steps:

- 4. Fill bucket with warm water.
- 5. Add soap to water.

Originally, these steps were simply performed in sequence as a continuation of the overall process. Now we have a requirement that dictates that should the resulting soap mixture be unacceptable, the bucket needs to be reset to its original state (empty). This requirement emulates an atomic transaction, where at the completion of Step 5, the process is either rolled back to the beginning of Step 4, or the quality of water is accepted (committed) so that it can be applied to washing the car.

# WEB SERVICES AND CONTEMPORARY SOA

## (PART I: ACTIVITY MANAGEMENT AND COMPOSITION)

### ACID transactions

- The protocols provided by the WS-AtomicTransaction specification enable cross-service transaction functionality comparable to the ACID-compliant transaction features found in most distributed application platforms.
- The term "ACID" is an acronym representing the following four required characteristics of a traditional transaction:

#### Atomic:

- Either all of the changes within the scope of the transaction succeed, or none of them succeed.
- This characteristic introduces the need for the rollback feature that is responsible for restoring any changes completed as part of a failed transaction to their original state.

#### Consistent :

- None of the data changes made as a result of the transaction can violate the validity of any associated data models.
- Any violations result in a rollback of the transaction.

# WEB SERVICES AND CONTEMPORARY SOA

## (PART I: ACTIVITY MANAGEMENT AND COMPOSITION)

### ACID transactions

Isolated:

- If multiple transactions occur concurrently, they may not interfere with each other.
- Each transaction must be guaranteed an isolated execution environment.

Durable:

- Upon the completion of a successful transaction, changes made as a result of the transaction can survive subsequent failures.

# WEB SERVICES AND CONTEMPORARY SOA

## (PART I: ACTIVITY MANAGEMENT AND COMPOSITION)

### Atomic transaction protocols

- WS-AtomicTransaction is a coordination type, is an extension created for use with the WS-Coordination context management framework.
- To participate in an atomic transaction, a service first receives a coordination context from the activation service.
- It can subsequently register for available atomic transaction protocols.
- The following primary transaction protocols are provided:

#### A Completion protocol:

- which is typically used to initiate the commit or abort states of the transaction.

#### The Durable 2PC protocol:

- for which services representing permanent data repositories should register.

#### The Volatile 2PC protocol:

- to be used by services managing non-persistent (temporary) data.
- Most often these protocols are used to enable a two-phase commit (2PC) that manages an atomic transaction across multiple service participants.

# WEB SERVICES AND CONTEMPORARY SOA

## (PART I: ACTIVITY MANAGEMENT AND COMPOSITION)

### The atomic transaction coordinator

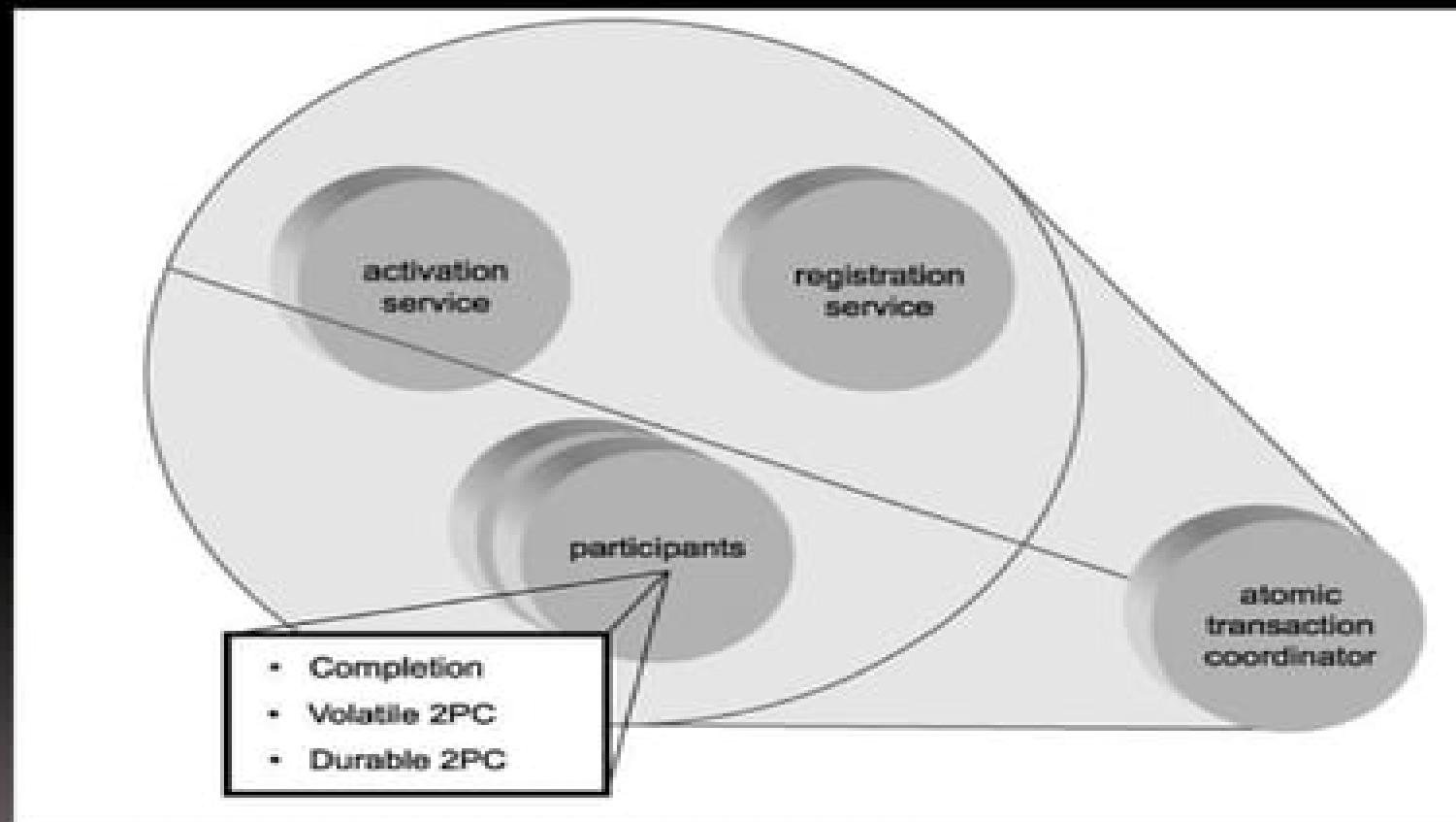
- When WS-AtomicTransaction protocols are used, the coordinator controller service can be referred to as an atomic transaction coordinator.
- This particular implementation of the WS-Coordination coordinator service represents a specific service model.
- The atomic transaction coordinator plays a key role in managing the participants of the transaction process and in deciding the transaction's ultimate outcome.

# WEB SERVICES AND CONTEMPORARY SOA

## (PART I: ACTIVITY MANAGEMENT AND COMPOSITION)

### The atomic transaction coordinator

#### The atomic transaction coordinator service model



# WEB SERVICES AND CONTEMPORARY SOA

## (PART I: ACTIVITY MANAGEMENT AND COMPOSITION)

### The atomic transaction process

- The atomic transaction coordinator is tasked with the responsibility of deciding the outcome of a transaction.
- It bases this decision on feedback it receives from all of the transaction participants.
- The collection of this feedback is separated into two phases.
- During the prepare phase , all participants are notified by the coordinator, and each is asked to prepare and then issue a vote.
- Each participant's vote consists of either a "commit" or "abort" request
- After the votes are collected, the atomic transaction coordinator enters the commit phase.
- It now reviews all votes and decides whether to commit or rollback the transaction.

# WEB SERVICES AND CONTEMPORARY SOA

## (PART I: ACTIVITY MANAGEMENT AND COMPOSITION)

### The atomic transaction process

The conditions of a commit decision are simple:

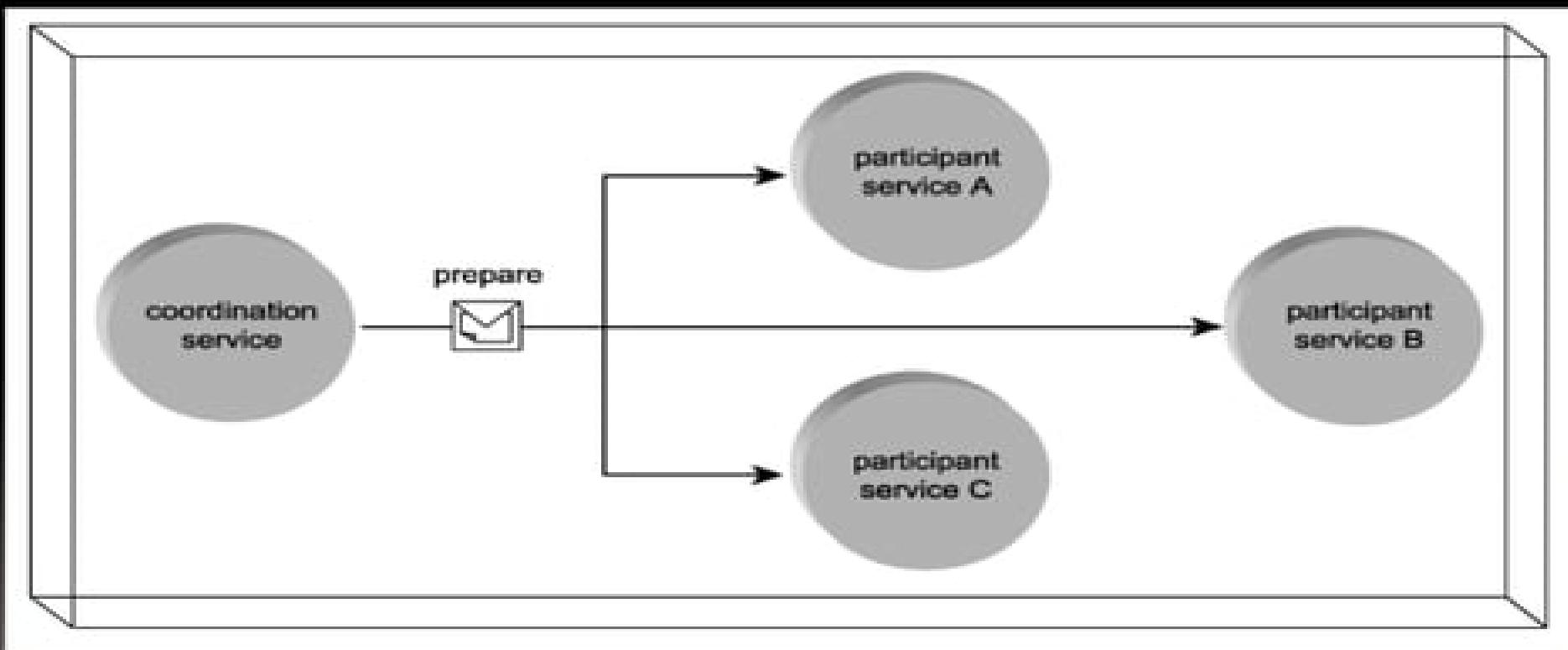
- if all votes are received and if all participants voted to commit, the coordinator declares the transaction successful, and the changes are committed.
- if any one vote requests an abort, or if any of the participants fail to respond, then the transaction is aborted, and all changes are rolled back

# WEB SERVICES AND CONTEMPORARY SOA

## (PART I: ACTIVITY MANAGEMENT AND COMPOSITION)

The atomic transaction process

The coordinator requesting that transaction participants prepare to vote

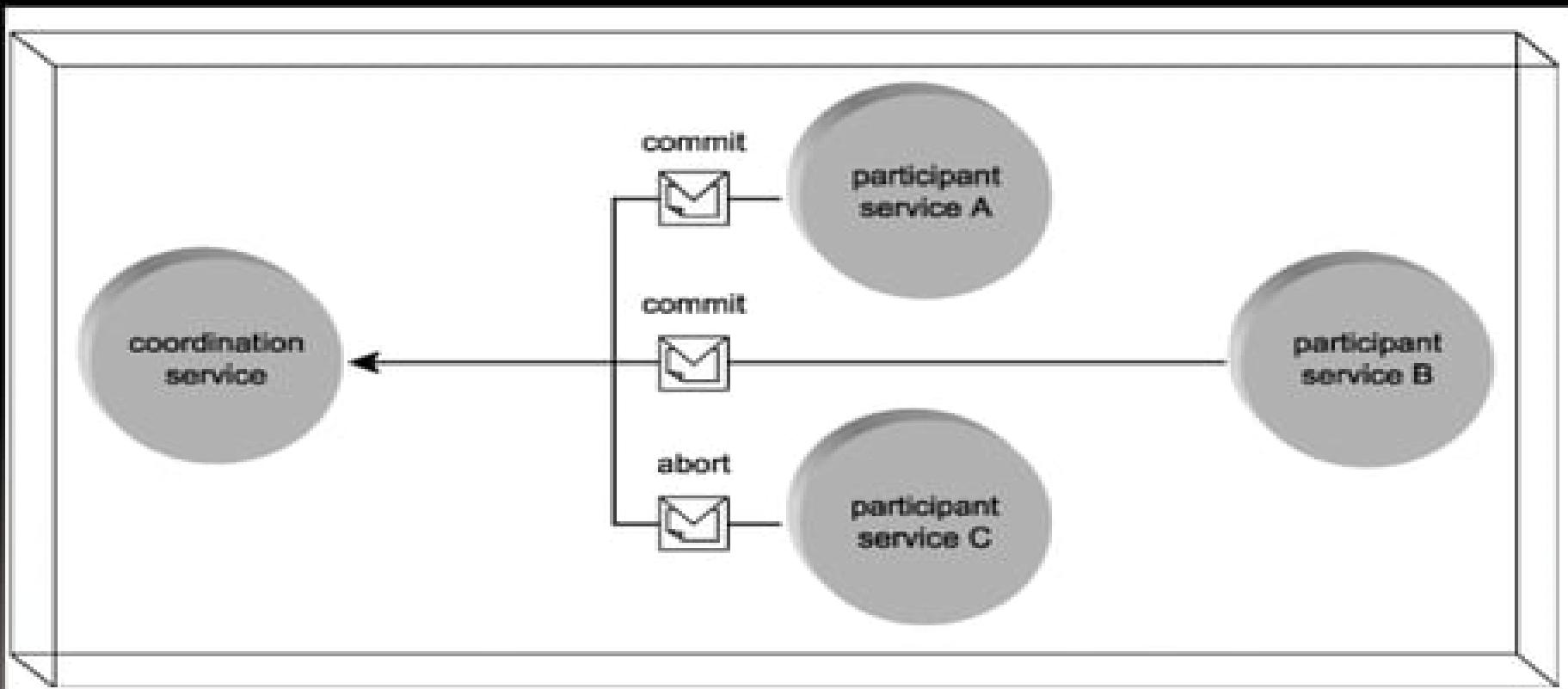


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## (PART I: ACTIVITY MANAGEMENT AND COMPOSITION)

### The atomic transaction process

The transaction participants voting on the outcome of the atomic transaction

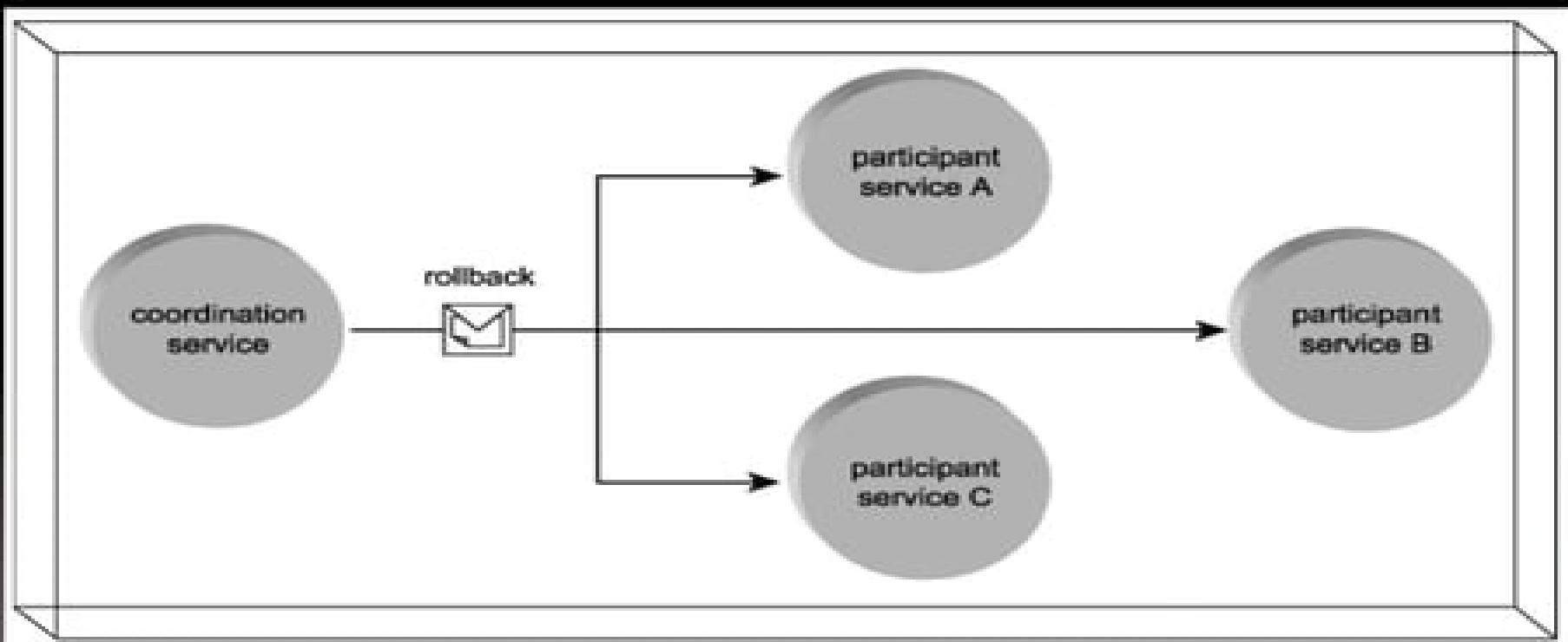


# WEB SERVICES AND CONTEMPORARY SOA

## (PART I: ACTIVITY MANAGEMENT AND COMPOSITION)

### The atomic transaction process

The coordinator aborting the transaction and notifying participants to rollback all changes



# WEB SERVICES AND CONTEMPORARY SOA

## (PART I: ACTIVITY MANAGEMENT AND COMPOSITION)

### Atomic transactions and SOA

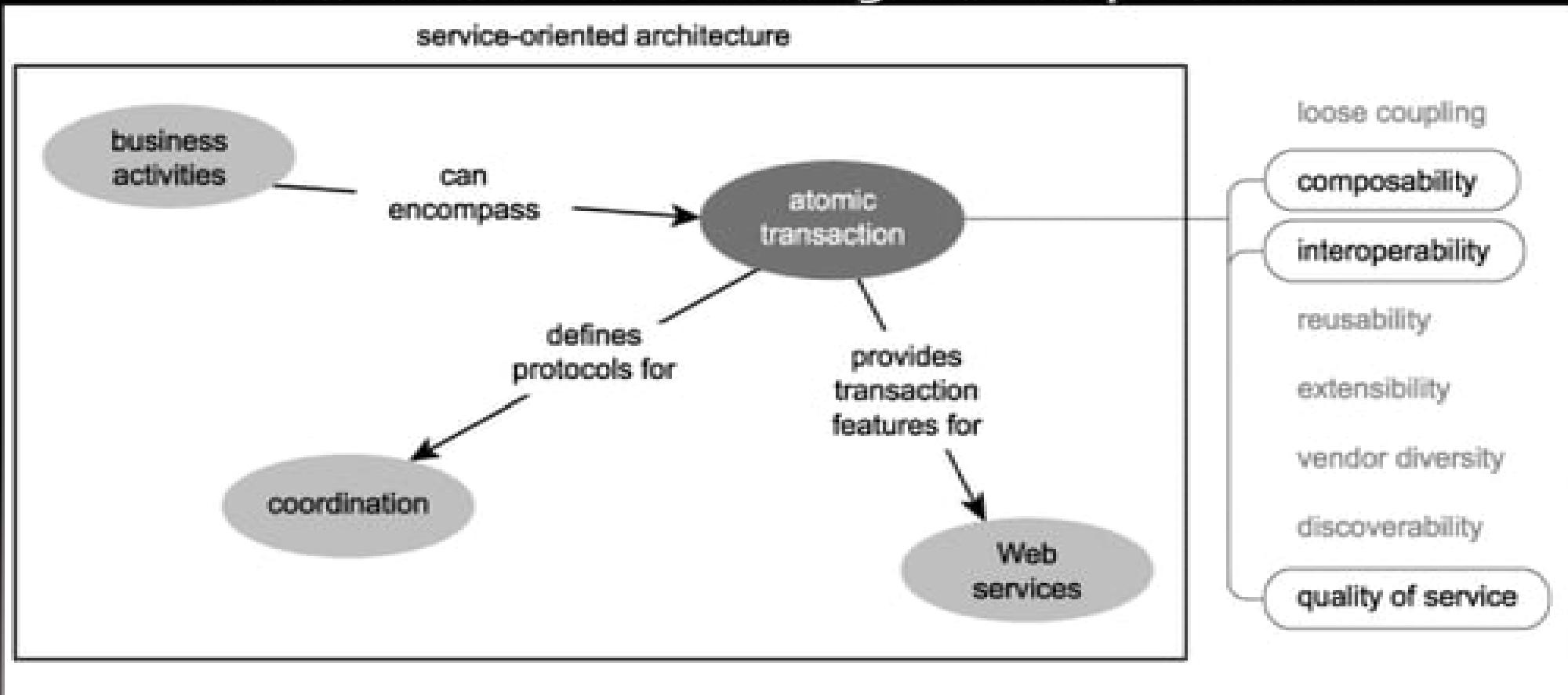
- As more services emerge within an organization and as service compositions become more commonplace, the need to move transaction boundaries into cross-service interaction scenarios increases.
- Being able to guarantee an outcome of an activity is a key part of enterprise-level computing, and atomic transactions therefore play an important role in ensuring quality of service.
- Not only do atomic transactional capabilities lead to a robust execution environment for SOA activities, they promote interoperability when extended into integrated environments.
- This allows the scope of an activity to span different solutions built with different vendor platforms, while still being assured a guaranteed all-or-nothing outcome.

# WEB SERVICES AND CONTEMPORARY SOA

## (PART I: ACTIVITY MANAGEMENT AND COMPOSITION)

### Atomic transactions and SOA

#### Atomic transaction relating to other parts of SOA



# WEB SERVICES AND CONTEMPORARY SOA

## (PART I: ACTIVITY MANAGEMENT AND COMPOSITION)

### Business activities

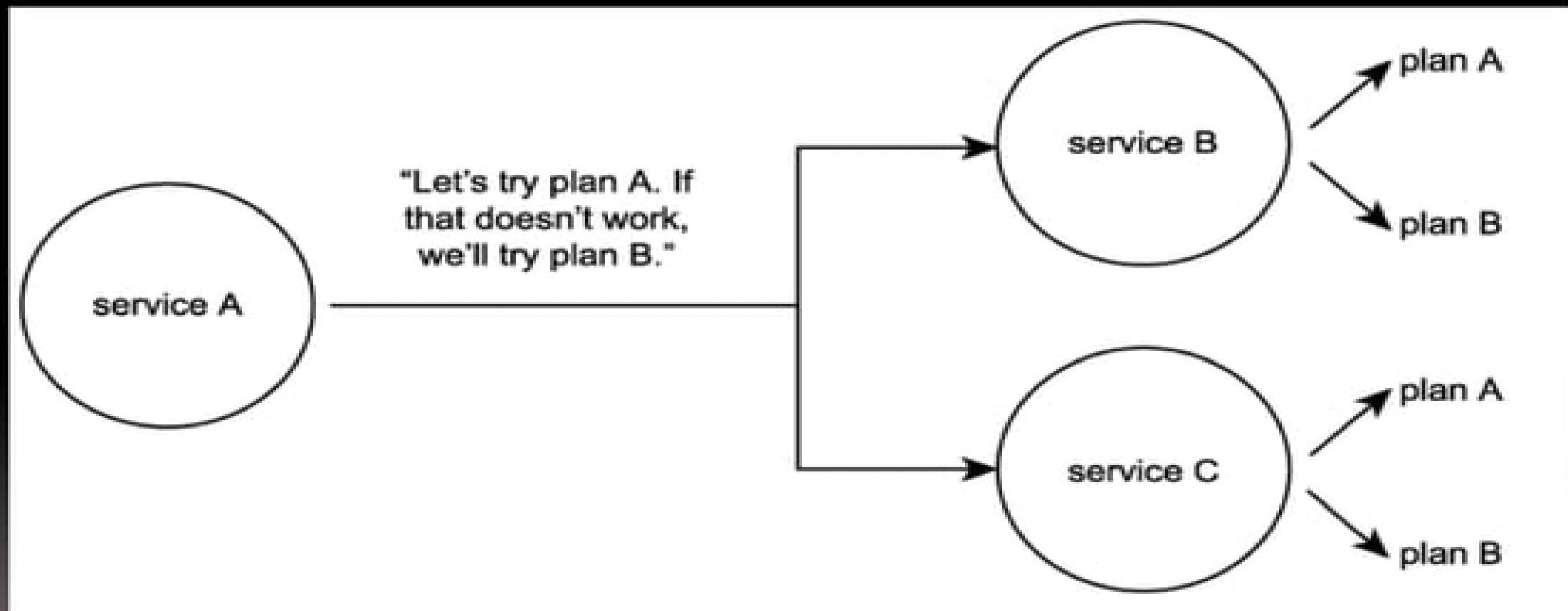
- Business activities govern long-running, complex service activities. Hours, days, or even weeks can pass before a business activity is able to complete.
- During this period, the activity can perform numerous tasks that involve many participants.
- business activity differs from a regular complex activity is that its participants are required to follow specific rules defined by protocols.
- Business activities differ from the protocol-based atomic transactions in how they deal with exceptions and in the nature of the constraints introduced by the protocol rules.business activity protocols do not offer rollback capabilities.
- The potential for business activities to be long-running, it would not be realistic to expect ACID-type transaction functionality.
- business activities provide an optional compensation process that, much like a "plan B," can be invoked when exception conditions are encountered

# WEB SERVICES AND CONTEMPORARY SOA

## (PART I: ACTIVITY MANAGEMENT AND COMPOSITION)

### Business activities

A business activity controls the integrity of a service activity by providing participants with a "plan B" (a compensation)



# WEB SERVICES AND CONTEMPORARY SOA

## (PART I: ACTIVITY MANAGEMENT AND COMPOSITION)

### Business activity protocols

- As with WS-AtomicTransaction, WS-BusinessActivity is a coordination type designed to leverage the WS-Coordination context management framework.
- It provides two very similar protocols, each of which dictates how a participant may behave within the overall business activity.
- The BusinessAgreementWithParticipantCompletion protocol, which allows a participant to determine when it has completed its part in the business activity.
- The BusinessAgreementWithCoordinatorCompletion protocol, which requires that a participant rely on the business activity coordinator to notify it that it has no further processing responsibilities.
- Business activity participants interact with the standard WS-Coordination coordinator composition to register for a protocol

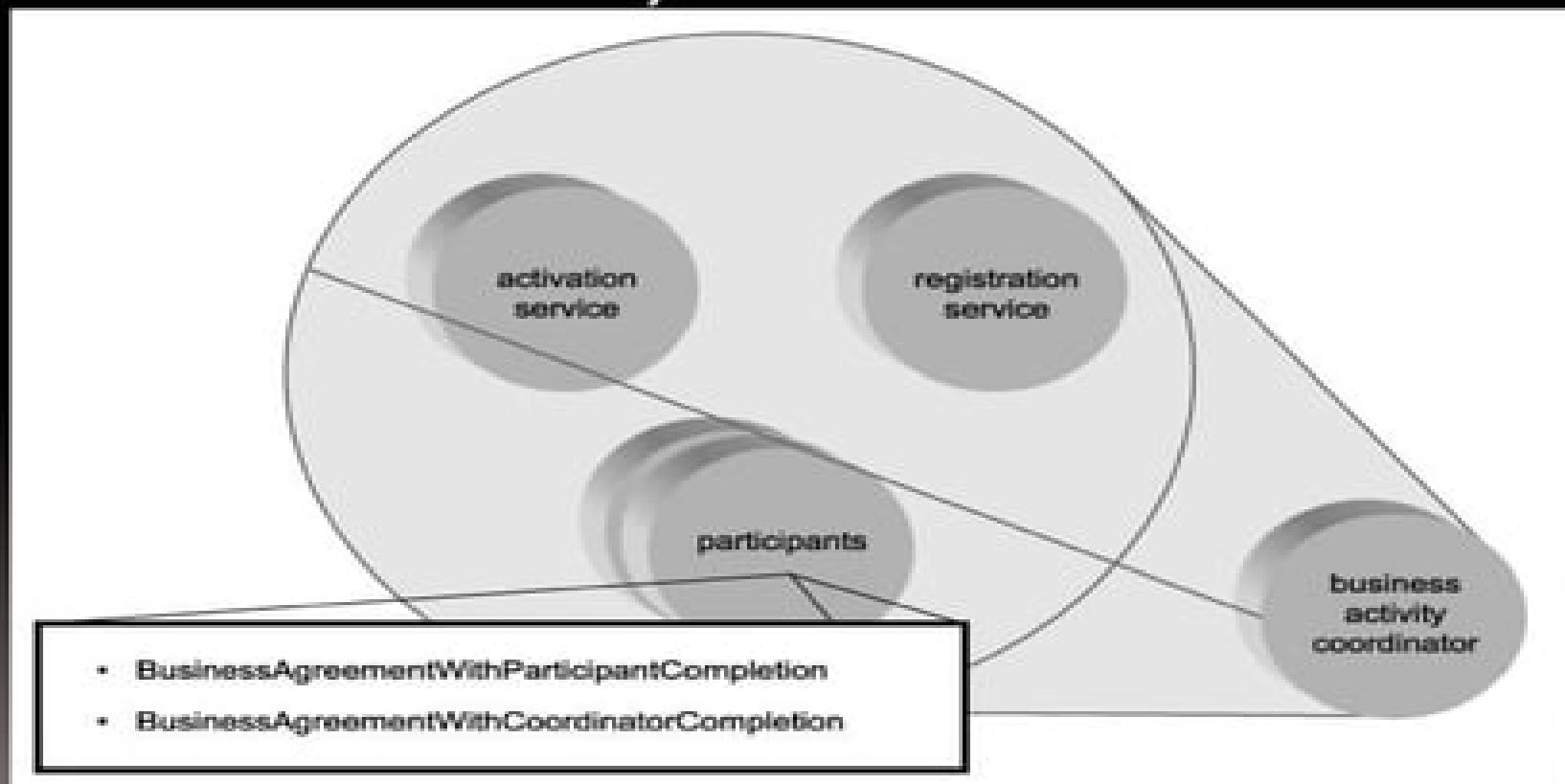
# WEB SERVICES AND CONTEMPORARY SOA

## (PART I: ACTIVITY MANAGEMENT AND COMPOSITION)

### The business activity coordinator

When its protocols are used, the WS-Coordination controller service assumes a role specific to the coordination type in this case it becomes a business activity coordinator .

### The business activity coordinator service model



# WEB SERVICES AND CONTEMPORARY SOA

## (PART I: ACTIVITY MANAGEMENT AND COMPOSITION)

### Business activity states

- During the lifecycle of a business activity, the business activity coordinator and the activity participants transition through a series of states.
- The actual point of transition occurs when special notification messages are passed between these services.
- a participant can indicate that it has completed the processing it was required to perform as part of the activity by issuing a completed notification. This moves the participant from an active state to a completed state.
- The coordinator may respond with a close message to let the participant know that the business activity is being successfully completed.
- if things don't go as planned during the course of a business activity, one of a number of options are available. Participants can enter a compensation state during which they attempt to perform some measure of exception handling. This generally invokes a separate compensation process that could involve a series of additional processing steps.

# WEB SERVICES AND CONTEMPORARY SOA

## (PART I: ACTIVITY MANAGEMENT AND COMPOSITION)

### Business activity states

- A compensation is different from an atomic transaction in that it is not expected to rollback any changes performed by the participating services; its purpose is generally to execute plan B when plan A fails.
- Alternatively, a cancelled state can be entered.
- This typically results in the termination of any further processing outside of the cancellation notifications that need to be distributed.

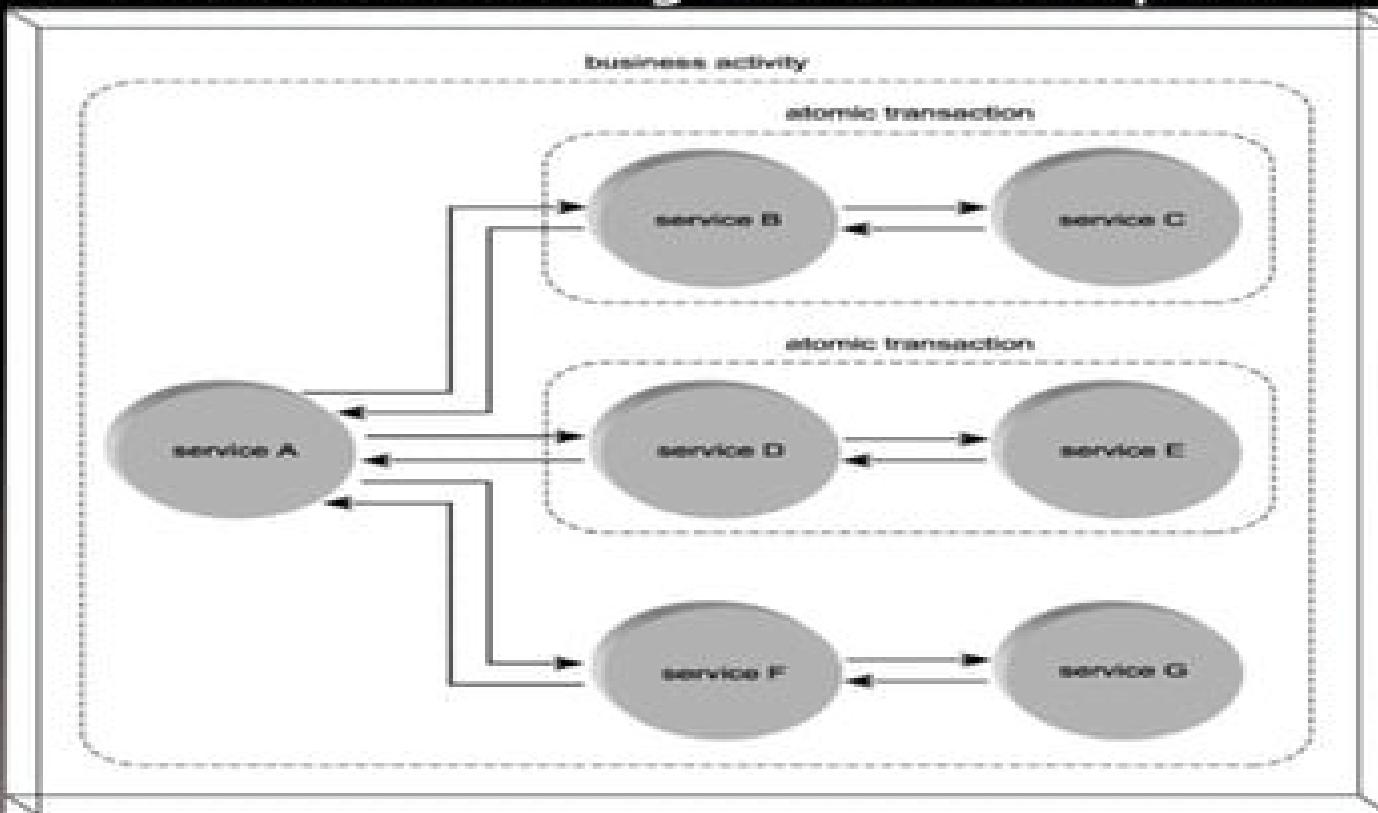
# WEB SERVICES AND CONTEMPORARY SOA

## (PART I: ACTIVITY MANAGEMENT AND COMPOSITION)

### Business activities and atomic transactions

- the use of a business activity does not exclude the use of atomic transactions. It is likely that a long-running business activity will encompass the execution of several atomic transactions during its lifetime

Two atomic transactions residing within the scope of a business activity



# WEB SERVICES AND CONTEMPORARY SOA

## (PART I: ACTIVITY MANAGEMENT AND COMPOSITION)

### Business activities and SOA

- Business activities fully complement the composable nature of SOA by tracking and regulating complex activities while also allowing them to carry on for long periods of time.
- Service autonomy and statelessness are preserved by permitting services to participate within an activity for only the duration they are absolutely required to.
- This also allows for the design of highly adaptive business activities wherein the participants can augment activity or process logic to accommodate changes in the business tasks being automated.
- Through the use of the compensation process, business activities increase SOA's quality of service by providing built-in fault handling logic.

# WEB SERVICES AND CONTEMPORARY SOA

## (PART I: ACTIVITY MANAGEMENT AND COMPOSITION)

A business activity relating to other parts of SOA

