Models for Web services transactions

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Overview

• Transactions and why they are important
• Web services and the problems they present
• Web services transactions specifications
  – OASIS BTP
  – WS-AtomicTransaction/WS-BusinessActivity
  – OASIS WS-TXM
Atomic transactions

• Scoping mechanism that provides “all-or-nothing” semantics
• Enables shared resources to be protected from concurrent users
• ACID properties
  – Atomic
  – Consistent
  – Isolated
  – Durable
Two-phase commit
B2B interactions

• Business-to-business interactions may be complex
  – involving many parties
  – spanning many different organisations
  – potentially lasting for hours or days

• Cannot afford to lock resources on behalf of an individual indefinitely

• May need to undo only a subset of work
Relaxing isolation

• Internal isolation or resources should be a decision for the service provider
  • E.g., commit early and define compensation activities
  • However, it does impact applications
    – Some users may want to know a priori what isolation policies are used

• Undo can be whatever is required
  • Before and after image
  • Entirely new business processes
Relaxing atomicity

• Sometimes it may be desirable to cancel some work without affecting the remainder
  – E.g., prefer to get airline seat now even without travel insurance

• Similar to nested transactions
  – Work performed within scope of a nested transaction is provisional
  – Failure does not affect enclosing transaction

• However, nested transactions may be too restrictive
  – Relaxing isolation
OASIS BTP

• Developed by BEA, HP, Oracle, Sun and others
• First real standards attempt
  – Not Web services specific
• Defines two transaction models
  – Atoms
  – Cohesions
Atom

- Uses two-phase termination protocol
  - prepare, confirm and cancel
  - Termination is atomic
    - All participants will do the same thing
    - Does not mandate how to implement prepare, confirm and cancel
      - E.g., prepare could be “charge credit card”
- Participants can signal upstream
- Does not say anything about isolation
  - Services cannot define isolation within the protocol
Cohesion

- prepare, confirm and cancel are parameterized
  - prepare and cancel can be called multiple times
- Work on a set of Atoms
  - Allows the confirm of a specific subset of work
    - Superset of Atom functionality
- Once subset is determined by business logic, the outcome will be atomic
- Does not talk about isolation
Example interaction

Internet

Taxi (participant)

Travel Agent (participant)

Restaurant (participant)

Theater (participant)

Transaction Coordinator Service

SIGMOD, June 13th-18th 2004, Paris, France
WS-AT/WS-BA

• Specifications released by BEA, IBM and Microsoft
• Separate coordination from transactions
• Define two transaction models
  – AtomicTransaction
    • Closely coupled, interoperability
  – Business Activities
    • Compensation based, for long duration activities
Atomic Transaction

• Assume ACID transactions
  – High degree of trust
  – Isolation for duration of transaction
  – Backward compensation techniques
  – Does not allow heuristic outcomes

• Integration with existing transaction systems
  – Important to leverage investments

• Interoperability between transaction systems
  – Something of a holy grail to date
Business Activities

- Workflow-like coordination and management
- Business activity can be partitioned into tasks
  - Parent and child relationships
    - Select subset of children to complete
    - Parent can deal with child failures without compromising forward progress
- Tasks can dynamically exist a business activity
- Tasks can indicate outcome earlier than termination
  - Up-calls rather than just down-calls
BA example
Compensating BA

SIGMOD, June 13th-18th 2004,
Paris, France
OASIS WS-TXM

• Specification from Arjuna, Fujitsu, IONA, Oracle, Sun and others
  – Part of WS-CAF
    • Three specifications
      – WS-Context
      – WS-Coordination Framework
      – WS-Transaction Management
• Three models
  – ACID transaction
    • For interoperability and high-cost services where ACID transactions are a requirement
      – Heuristics allowed
  – Long running action
    • Loosely coupled, long duration work that uses compensations
  – Business process
    • For gluing together different transaction models, with different implementations, into a single global transaction
Long running action

• Specifically for long duration interactions
  – Could be used for short duration

• Spheres of compensation
  – Can be nested (parent-child relationship)

• Compensation actions
  – Return the business state to consistency
    • E.g., credit your credit card and give you back interest payments
Business process

- All parties reside within *business domains*
  - May represent a different transaction model and implementation
    - ACID, compensation, message-oriented, …
- Business process is split into *business tasks*
  - Compensatable units of work
    - Forward compensation during activity is allowed
  - Can be check-pointed and restarted by business process during flow of activity
    - Support for manual intervention
Commonality

• ACID transaction model
  – Interoperability with existing infrastructures
  – Well understood model and semantics
    • Lots of tool support

• Compensation model
  – Forward recovery
  – Better model for long duration interactions
    • Requires more work from applications and users
      – Potentially more complex model
    • Compensations specific to requirements
      – Requires tool support
Are they sufficient?

- WS-AT/WS-BA and WS-TXM have similar roots
  - Micro-protocol approach
    - One-size does not fit all
    - Tailor transaction model to specific requirements
- The models suit current use cases
  - Further expansion is allowed
  - Web services evolution
Conclusions

• Very active subject
• Two models are common
  – Backward compensation
    • ACID for interoperability
  – Forward compensation
    • Matches business models and allows independent structuring
• Try them out!
  – Should there be additional protocols?