Web Services and Transactions

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Agenda

- Web Services and Transactions
  - Long-running Transactions
  - Web Services
- Specifications and Standards
- Compare
  - WS-Transaction and WS-Coordination
  - Business Transaction Processing
- Driving Convergence
- Conclusions
- References

Why do Web Services Need Transactions?

- Loosely-coupled
- Distributed
- Coordination is an issue except for single sequence
  - Make error-prone complex transactions easier to program
- New requirements for independent participants
  - One coordinator can't demand all participants follow the coordinator's business rules
  - Isolation hard to maintain—one transaction affects another
- XML-based transaction protocols for interoperability

The Case for Long-running Transactions

- Existing businesses do them often
- Travel agent scenario
  - Multiple resources
  - Variable cost to change/cancel
  - Business rules vary
  - Need some consistent set of tickets/reservations
  - Need a deterministic agreed outcome
- Compensation rather than rollback (usually)—cancel reservation

Transactions Support Workflow and Choreography

- BPEL4WS
- Web Services Choreography Interface (W3C Note)
- ebXML Business Process interactions
- Details BTP support for workflows in Potts, Temel paper (see References)
  - WSFL
  - XLANG
  - BPML

Web Services and Transactions

- To integrate transactions and Web services need to carry one or more of
  - Correlation ID
  - Conversation ID (for long-running conversations, not necessarily transactional—viz. WLStudio)
  - Transaction context ID (integer, for atomic single-site)
  - Additional context information
- Placed in SOAP Header
- Potential for conflicts as SOAP Header is used more and more

Specifications and Standards

- When is a specification not a standard?
- Is the protocol or API over-specified? Under-specified?
- How interoperable is the protocol?
- Automatic or manual configuration?
- Optimized for common cases?
- Consistent architecture and programming model?

The Landscape Today

- WS-Transaction + WS-Coordination (WS-T/WS-C)
- OASIS Business Transaction Processing (BTP)
- Others (see references)

WS-Transaction and WS-Coordination

- Published August 2002 by BEA, IBM, and Microsoft
- Factors out transaction context management and propagation into WS-Coordination
- XML with Web services binding
- Two sub-protocols in WS-T
  - Atomic Transactions (AT)
  - Business Activities (BA)

WS-T and WS-C (continued)

- WS-T/AT (atomic) transactions are essentially traditional and tightly-coupled (ACID) — Atomic, Consistent, Isolated, Durable
- Business Activities are richer and allow for looser coupling, relaxation of Isolation and Atomicity
- Both provide Web service/SOAP bindings

OASIS Business Transaction Protocol

- Technical Committee created March 2001 by BEA, Interwoven, and Sun, soon joined by others
- Committee Specification 1.0 May 2002
- XML, with SOAP binding
- Two sub-protocols relax ACID properties
  - Atoms—Isolation is relaxed
  - Cohesions—Isolation and Atomicity are relaxed

OASIS BTP
(continued)

- Atoms do (mostly) what atomic transactions do
- Cohesions do (mostly) what business processes do, and are similar to WS-T Business Activities
- Most messages are the same across the two protocols (it's really two kinds of coordinators)

Compare

- Superficial Similarities
- Real Similarities
- Messages
- State Diagrams

Superficial Similarities

- At a high level one might hope that the models align:
  - WS-T/AT =?= BTP-Atoms
  - WS-T/BA =?= BTP-Cohesions
  - WC-Coordination manages contexts as BTP does
  - Both use XML and Web Services
- But they don't.
- The protocols seem similar
- And they are, but optimizations and scalability are needed for WS-C/WS-T

A Clearer Comparison

WS-T/WS-C	BTP
Business Activity	Cohesions
*	Atoms
Atomic Transaction	**
Web Services	XML with SOAP binding

- * WS-Transaction doesn't address this except as a special case of Business Activity
- **BTP doesn't address this as loosely coupled implementation of tightly-coupled transactions were explicitly ruled out early on

A Clearer Comparison (continued)

- Isolation
  - WS-T/AT mandates strict isolation, while BTP relaxes isolation—BTP is more loosely coupled
- Binding
  - WS-T/WS-C tightly bound to Web Services. BTP is an XML message protocol with a SOAP binding
- Optimizations
  - BTP “One Shot” optimization should be used in loosely-coupled interactions with high latency
  - BTP allows participants to resign without waiting for coordinator, and allows timeouts for commitments
- WS-T/AT can work well in a tightly-coupled environment

Real Similarities

- Both WS-T/WS-C and BTP can be used to support business process execution environments, e.g. BPEL4WS, WSFL, WSCI, BPMI, and others
- WS-T Business Activities are similar to BTP Cohesions

Real Similarities (continued)

- Compensating actions are a problem if too common (the protocol should prevent errors and aid recovery)
- Both are useful as an *implementing* technology, e.g. for workflows
- Both are relatively low level and complex
- Neither is the only solution in its problem domain

Real Differences

(see references)

- WS-T/AT is not loosely-coupled
- BTP incorporates optimizations
  - One-Shot
  - Participant resignation
  - Timeouts
- WS-C/WS-T is under specified—there's not enough to build interoperable implementations from the specs
- WS-T/AT and WS-T/BA are similar but use different messages
- Factoring out of WS-C complicates the transaction protocol
- BTP is an OASIS Committee Specification

Messages—Normal Case

- Normal case: WS-T/AT 1PC or 2PC

Role: Coordinator	*Role:* Participant
Prepare	Prepared
Commit || Rollback	Committed || Aborted

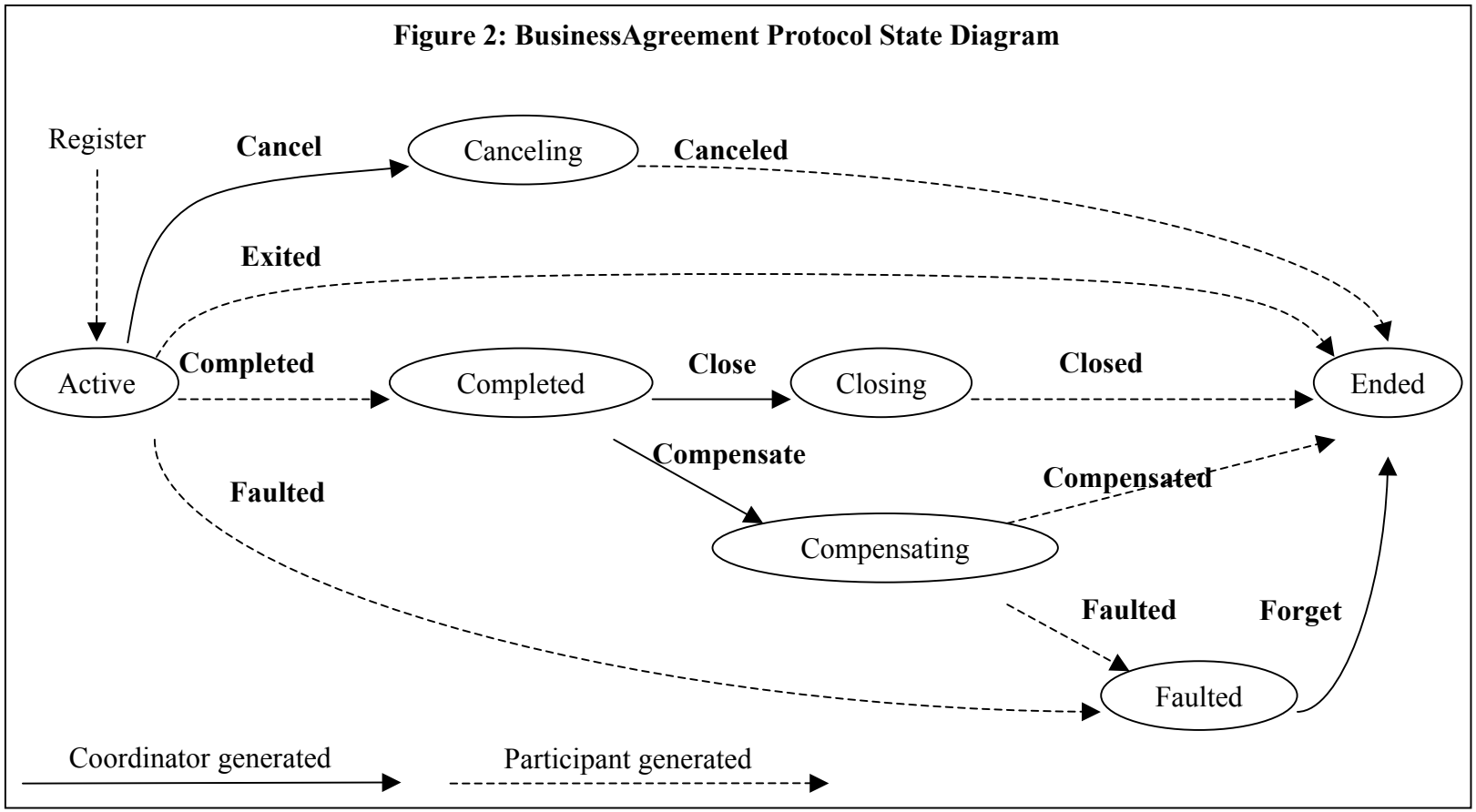
- Normal case: WS-T/BA with Completion

Role: Coordinator	*Role:* Participant
Prepare	Prepared
Close || Compensate	Closed || Compensated

- Normal case: BTP

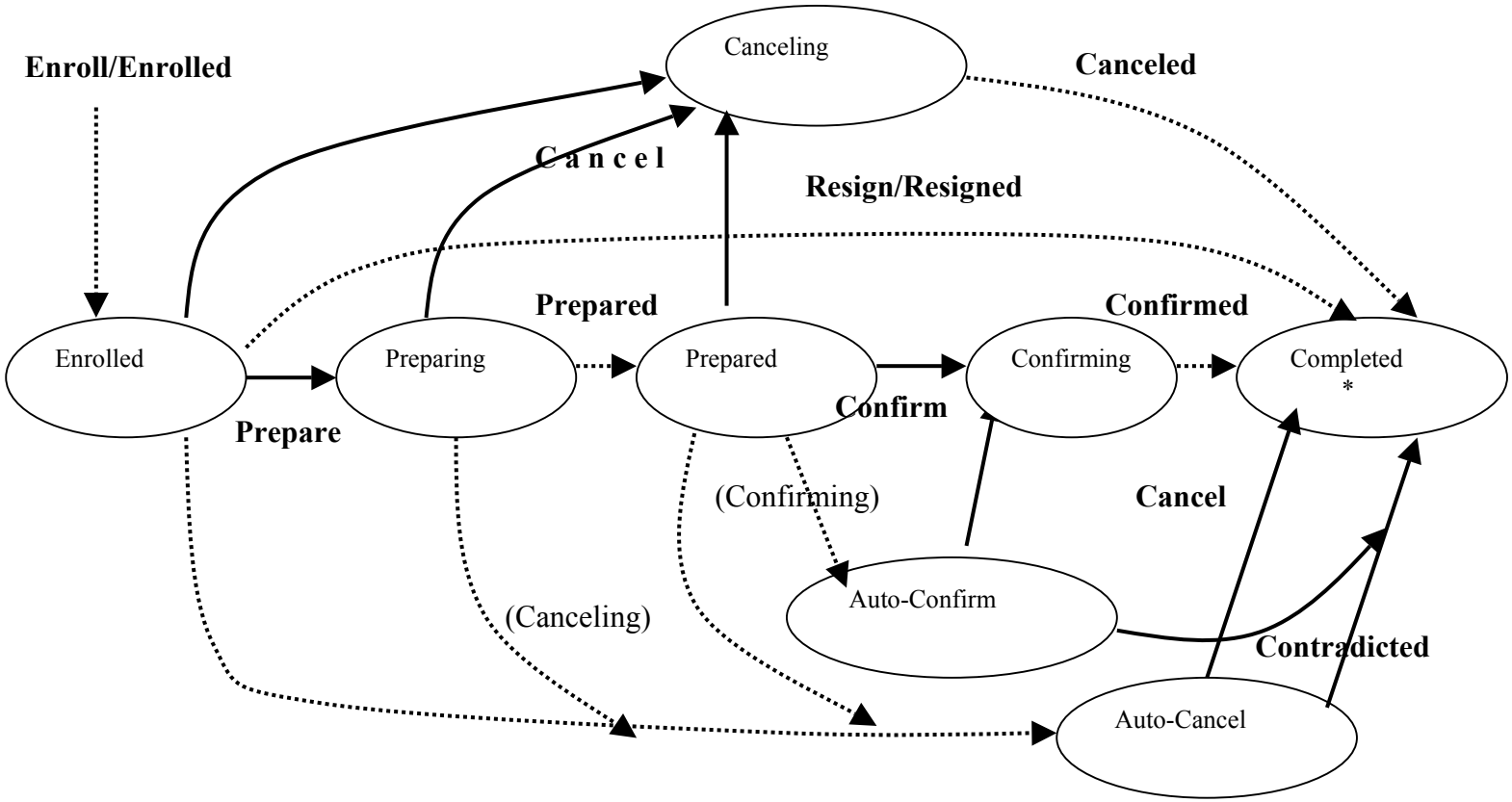
Role: Superior	*Role:* Inferior
Prepare	Prepared
Confirm || Cancel	Confirmed || Cancelled

WS-C/WS-T State Diagram



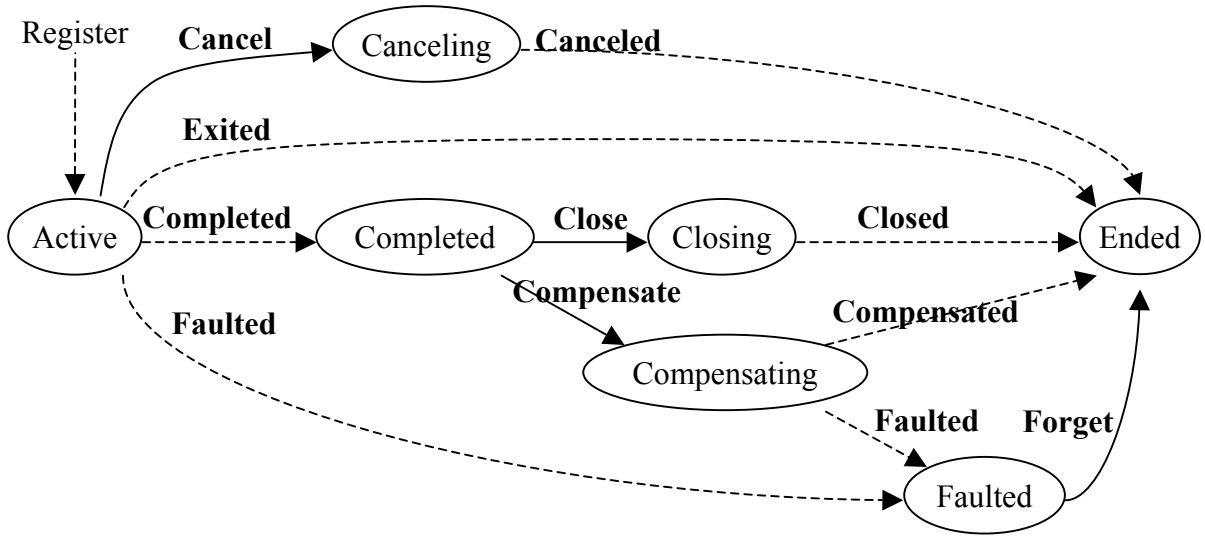
WS-Transaction Specification BA Figure 2

BTP State Diagram Without Optimizations

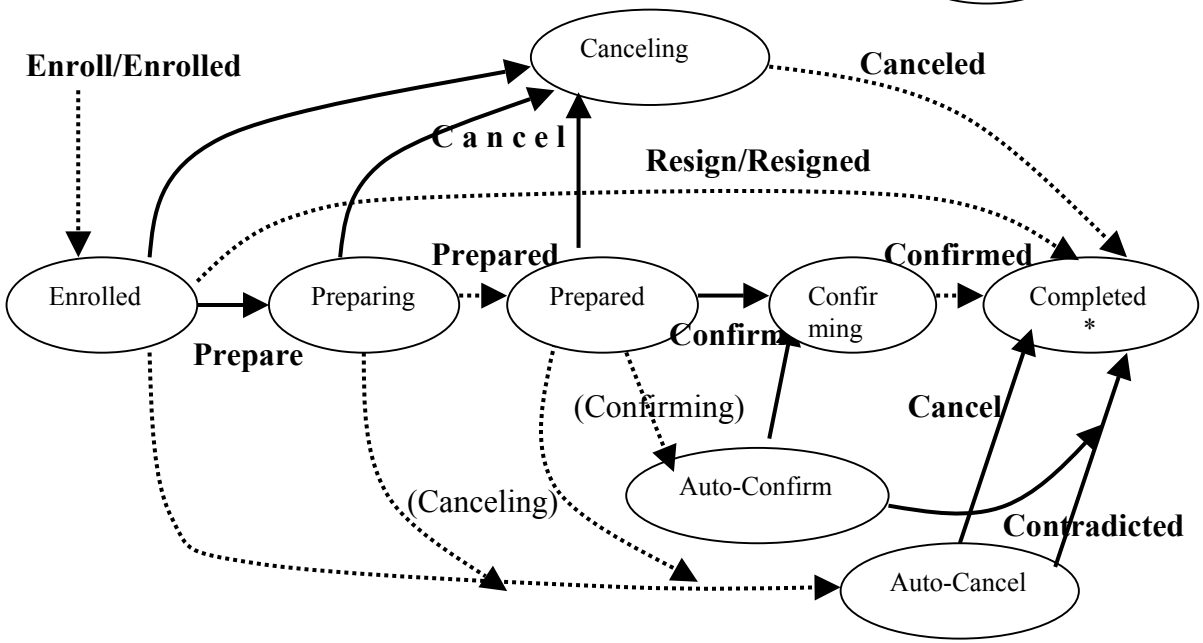


Courtesy Sazi Temel

WS-T



BTP



Superior (coordinator) generated

Inferior (participant) generated

Specifications and Standards (again)

- When is a specification not a standard?
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Driving Convergence

- BTP and WS-Transaction/WS-Coordination overlap in significant areas
- Similar goals, different details
- Industry would be well-served by convergence in this space
- Standards submission of WS-Transaction and WS-Coordination would be the next step in driving convergence

Conclusions

- Both technologies approach broad and complex issues
- Both technologies can support aggregations including composition, workflows, and choreography
- Convergence is going to be important—the industry needs one standard, not two similar-but-different ones
- Either can simplify distributed agreement without making you “roll your own”

References

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  - WS-Coordination
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  - Technical discussion
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