

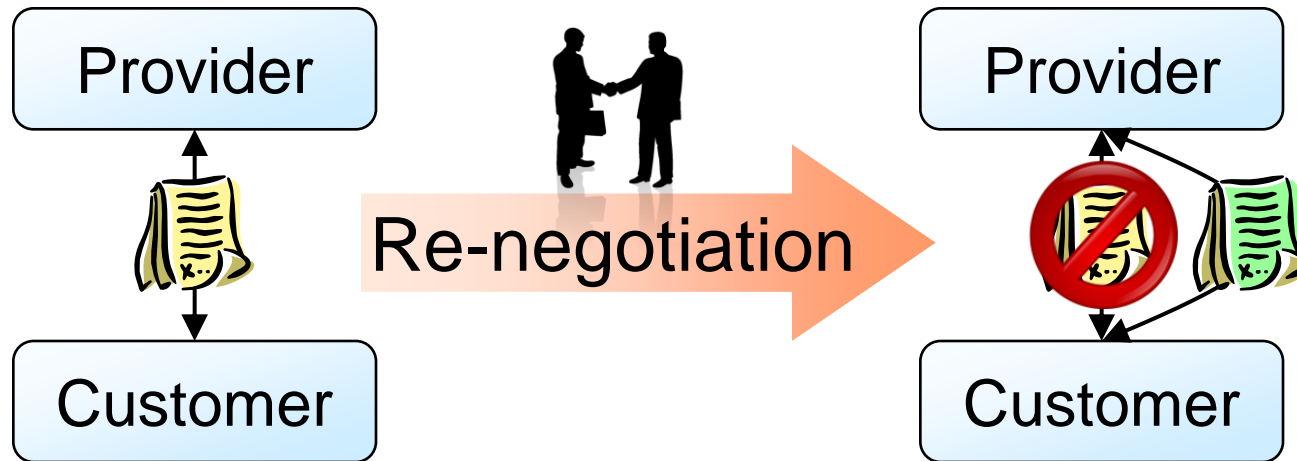
An SLA Re-Negotiation Protocol

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What is Re-Negotiation?

- Further negotiation of existing contract to change terms of that contract
- If successful, a new contract replaces existing one
- Can be initiated by both partners
- Can be terminated by both partners



Why Re-Negotiation?

- Circumstances changed since negotiation of original contract
- Examples
 - customer: more CPU cycles are needed to finish computation than originally estimated
 - provider: unexpected unavailability of promised resources

Design Assumptions

- Network can fail: messages can be delayed, lost, duplicated, re-ordered
 - protocol should work correctly in such environments
- Loose consistency is okay: provider and consumer can have (temporarily) different view of state of SLA

Design Approach

- Define protocol on abstract level
 - implementation-technology-independent
 - later on map to realization technology
 - define messages, meaning, SLA state machine
 - define allowed message sequences and state transitions by pre- and postconditions (no MSCs)
- Protocol must be independent of application domain
 - terms within SLA do not affect re-negotiation protocol
- Multi-round negotiation

Protocol “Phases”

- Non-binding exchange of offers
 - to find terms acceptable to both sides
 - both partners can initiate this process
- Establish binding agreement
 - results in a new SLA
 - existing one is revoked
 - both partners have to agree
 - initiated only by the customer

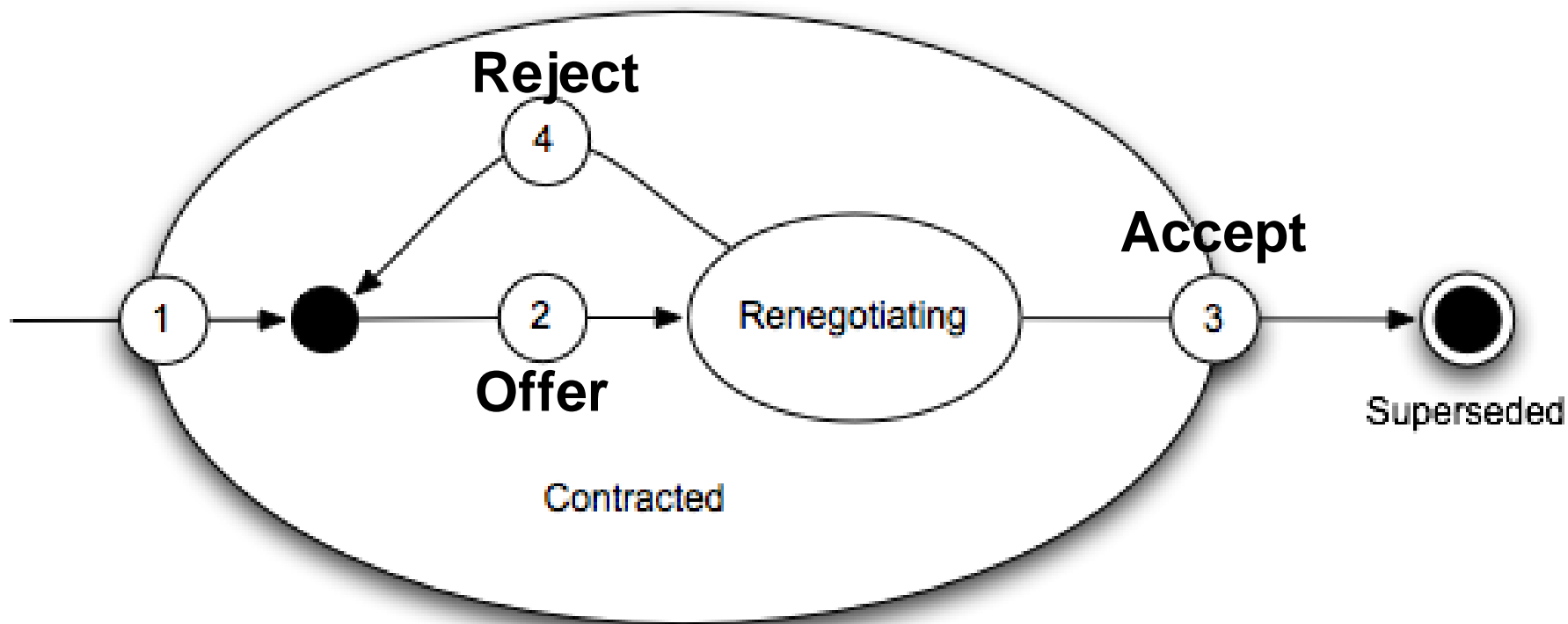
Messages

- RenegotiationQuoteRequest, RenegotiationQuote
 - non-binding exchange of quotes
- RenegotiationOffer, RenegotiationOfferAck, RenegotiationAccept, RenegotiationReject
 - binding offer exchange
- RenegotiationNotPossible
 - indicate unwillingness to re-negotiate an SLA

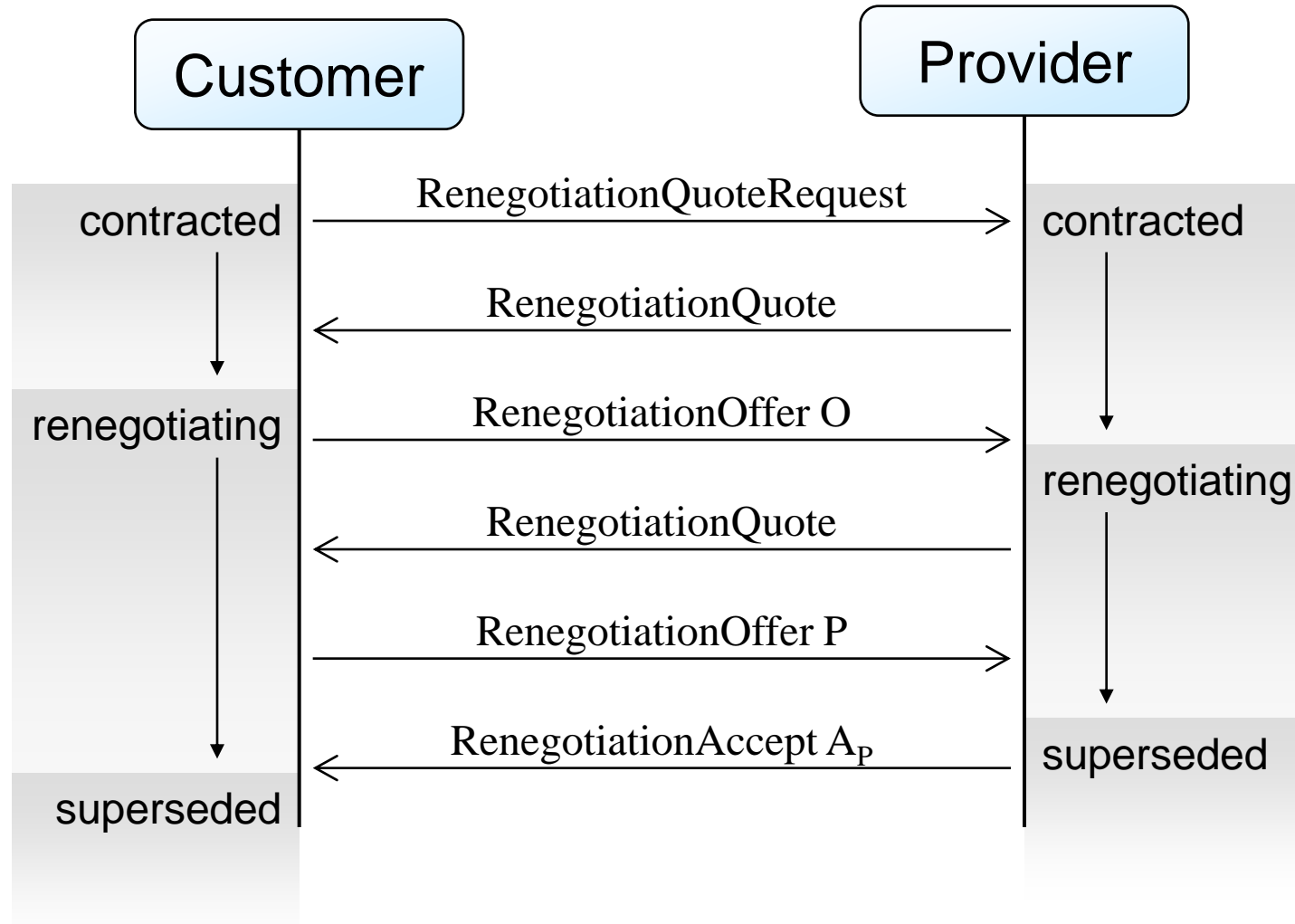
Safety Properties

- Only an offer that has been made can be accepted
- Only one offer can be accepted in an instance of the re-negotiation protocol
- Acceptance of an offer revokes all other outstanding offers
- Rejected offer cannot be accepted later
- Receipt of RenegotiationNotPossible by client revokes all outstanding offers

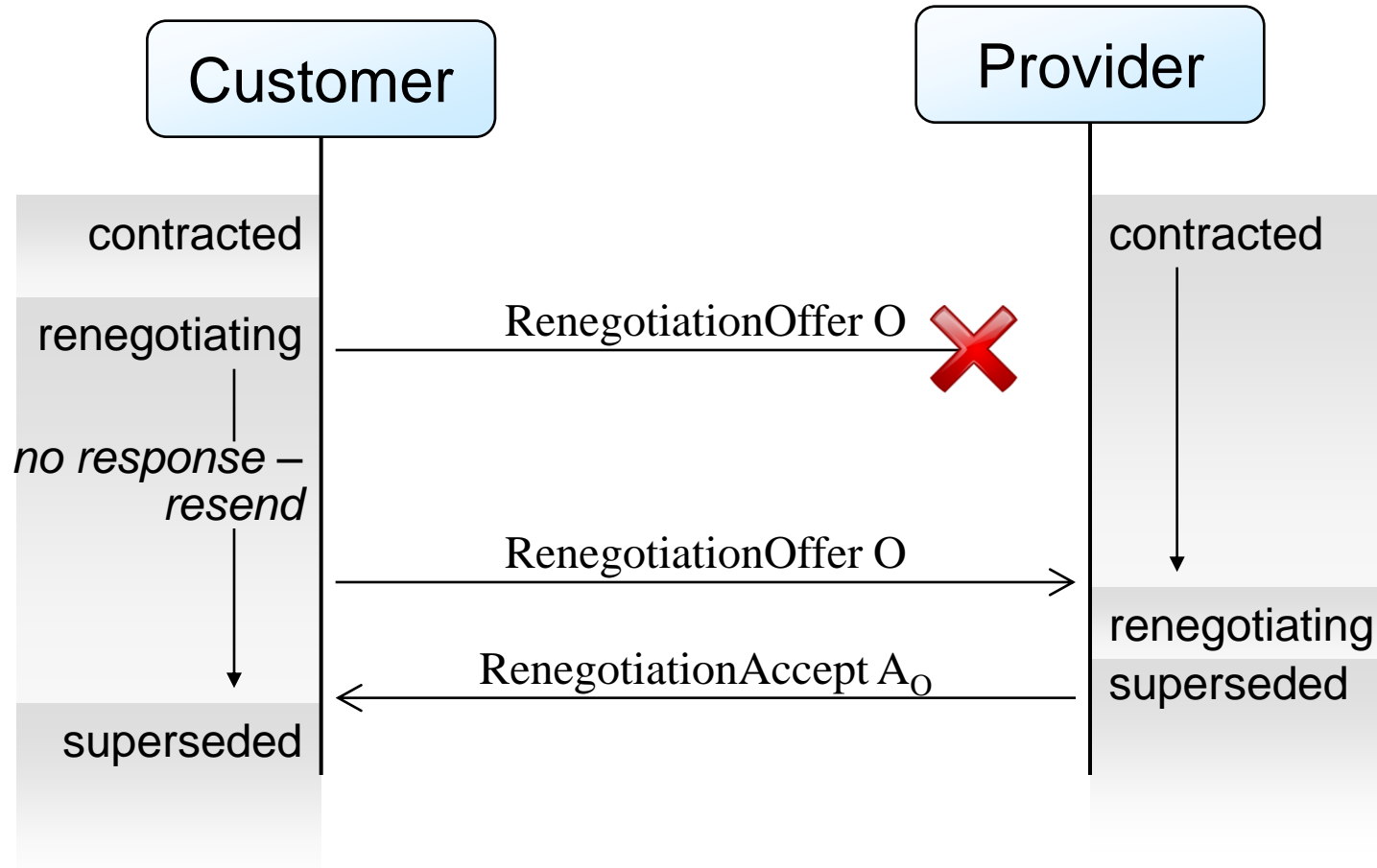
Contract State Machine



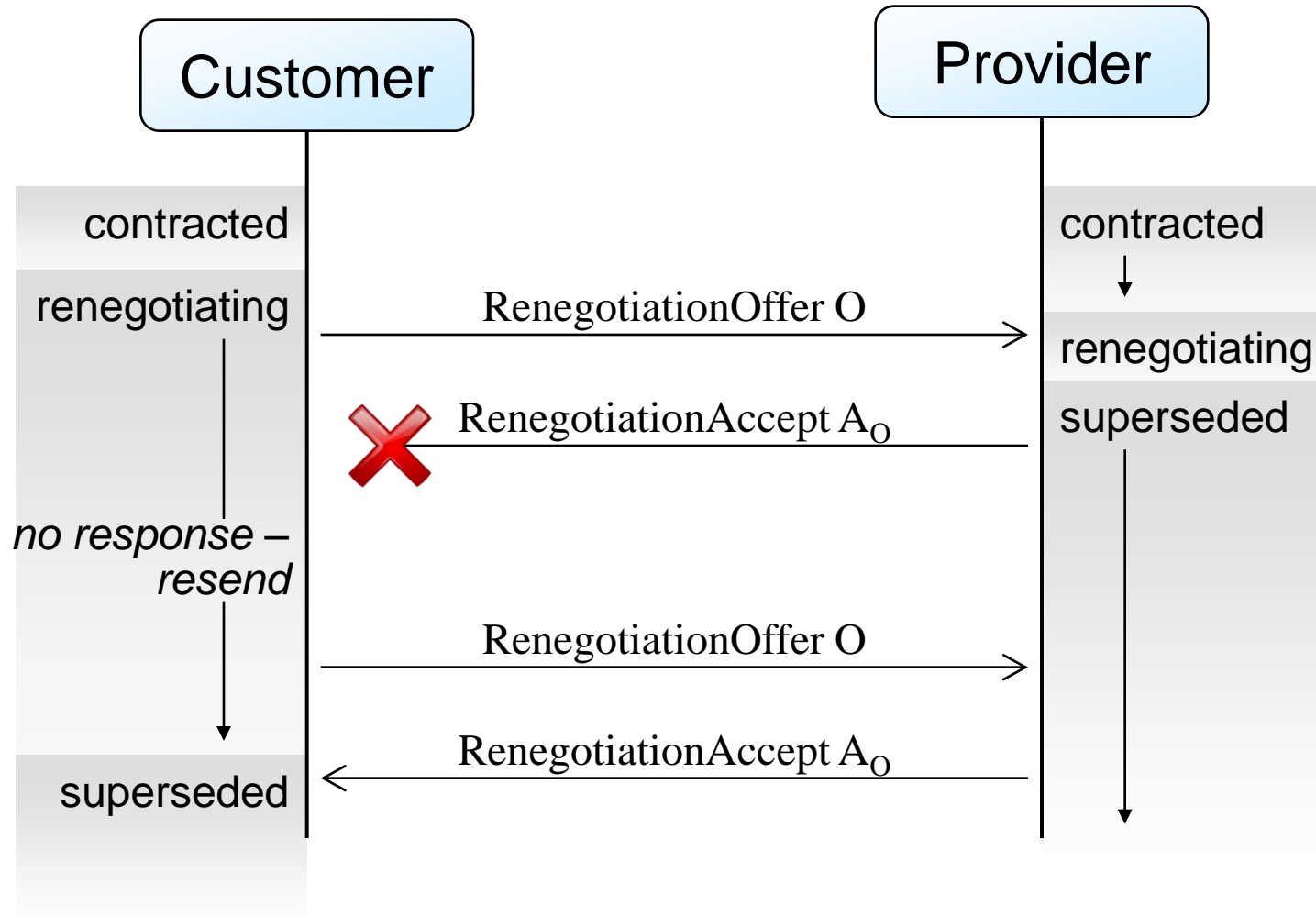
Example 1



Example 2



Example 3



Conclusion

- Defined protocol for contract re-negotiation
- Robust operation in networked environments
 - can deal with message loss, duplication, delay, reordering
- Domain-independent
- Defined messages, state machine and allowed sequences via pre- and post-conditions

Future Work

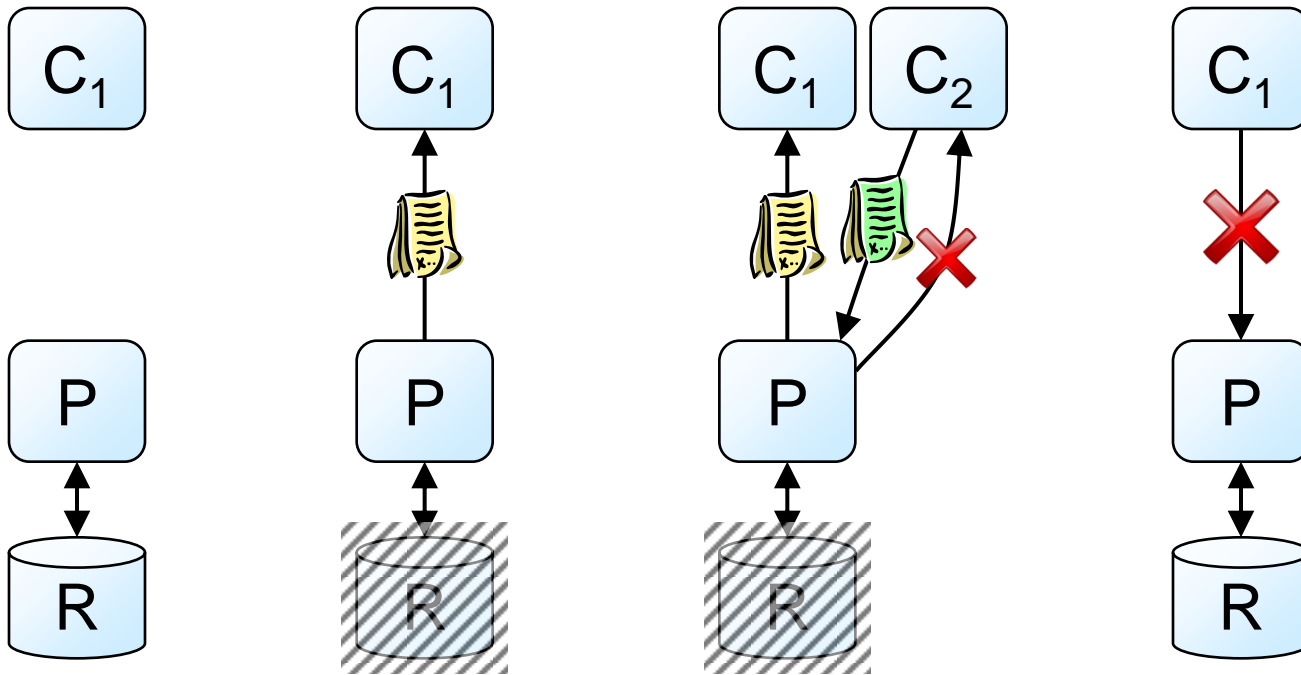
- Develop mapping to realization technology, e.g. Web Services
 - mapping to RPC might restrict protocol flows
- Standardize
 - participation in OGF's GRAAP group

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Provider-Initiated



Customer-Initiated

