



A Model for the E-Service Marketplace

Anna Durante, David Bell, Louis Goldstein,
Jon Gustafson, Harumi Kuno
Software Technology Laboratory
HP Laboratories Palo Alto
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HP's E-Services vision presents a new model for electronic business. First, it foresees a marketplace that supports the acts of brokering and auctions and that enables the dynamic creation and fulfillment of agreements for E-Services. Second, in order for E-Services to be brokered automatically (without human intervention), it must be possible to construct connections between E-Services dynamically. Third, the E-Services must have some means of being represented (or of representing itself) in "loosely coupled interactions" (for example, in an auction). That is, the e-services vision foresees an established electronic marketplace in which contracts can be automatically negotiated and E-Services can be dynamically composed. This paper proposes a model for E-Service marketplaces. We define key elements, roles, and objects, and discuss the responsibilities and collaborators for each role and object.

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1 Introduction

HP's E-Services vision transforms current paradigms of e-commerce by replacing the assumptions of B2C and point-to-point B2B connections with a many-to-many B2B model. It transforms the paradigm of the isolated storefront by enabling the storefront to buy from and sell to other E-Services as peers. It transforms the application hosting paradigm by allowing an E-Service to dynamically discover and connect to E-Services hosted by other providers. It transforms out-sourcing paradigms by automating the process for connecting heterogeneous E-Services, enabling the entire process to occur electronically, potentially without human intervention. E-commerce services will be connected to the numerous E-Services that manage the other business-related activities (e.g. business returns or supply chain management). Transactions and workflow will span across all of these services, and an event in one service will be able to trigger actions in another.

This vision presents a new model for electronic business. First, it foresees a marketplace that supports the acts of brokering and auctions and that enables the dynamic creation and fulfillment of agreements for E-Services. Second, in order for E-Services to be brokered automatically (without human intervention), it must be possible to construct connections between E-Services dynamically. Third, the E-Services must have some means of being represented (or of representing itself) in "loosely coupled interactions" (for example, in an auction). That is, the e-services vision foresees an established electronic marketplace in which contracts can be automatically negotiated and E-Services can be dynamically composed.

The goal of the E-Services Architecture Project (ESAP) is to develop an architecture specification for a platform that supports the rapid and easy development and deployment of basic and composite e-services, while leveraging infrastructure technologies like ChaiServer, E-Speak, or Jini. In this paper, we propose a model for E-Service marketplaces. We define key elements, roles, and objects, and discuss the responsibilities and collaborators for each role and object.

We begin by defining five key elements of an E-Service Market Model in Section 1. We break this model down into the primary roles and objects for each element in Section 3, and also provide details on the responsibilities and collaborators for each role and object. We present a high-level overview of the overall E-Service lifecycle, including phases of creation and usage, in Section 4.

2 E-Service Market Model

The E-Service Market Model aims to define the primary elements of an overall e-service market. These elements represent a unique set of contributions that together form the foundation for e-service creation and transactions. The Market Model elements are defined as follows:

- **Transaction Participants** which represent the parties that will be the primary participants in a transaction. A transaction can involve two or more parties.
- **Mediators** which represent the entities that enable a match between a Buyer and a Service Provider such that an agreement (sometimes documented in a contract) is formed.
- **Market Makers** which represent the entities that ensure the transaction is completed as agreed upon. This is an important element because it creates the trust to enable market transactions.
- **Financial Managers** which represent the entities that support the financial aspects of an e-service transaction. This includes billing, payment, and funding.
- **Lifecycle Managers** which represent the entities that manage the lifecycle aspects of service creation and usage. This includes composition, provisioning, deployment, fulfillment and functional management.

Not every e-service requires all of the Market Model elements. An e-service market can be as simple as low risk transactions between minimal participants that require no contract, or as complex as a set of transactions that involve numerous, anonymous participants and require an extensive support system. In either case, there is an overall model for doing business, and the nature of the transaction dictates how many elements of the model will be required. At a minimum, there will always be two Transaction Participants.

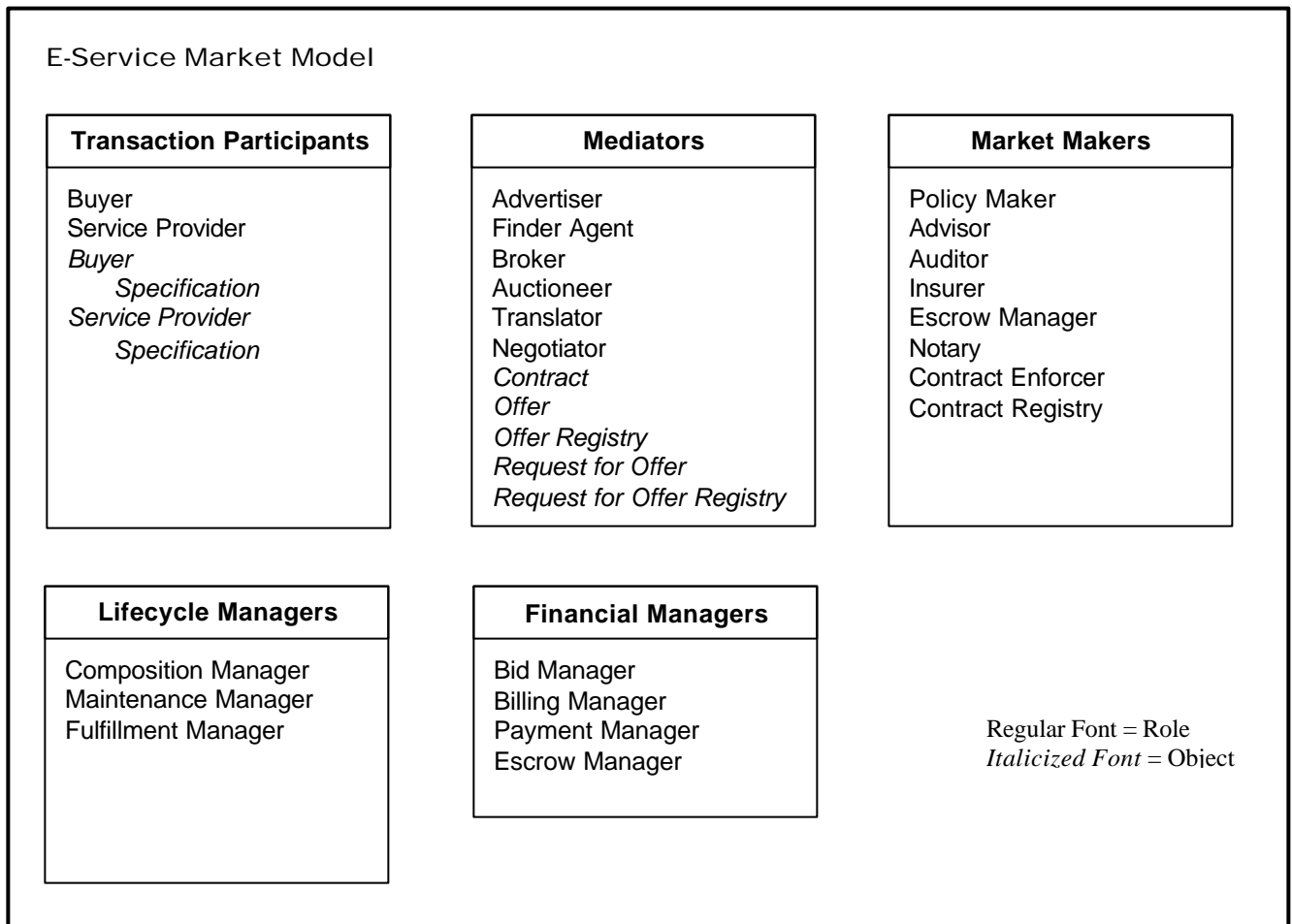
In the following sections, each of these elements are given more definition by presenting the underlying Roles and Objects that support each element. The diagram below provides a summary of the Market Model along with its underlying Roles and Objects:

A Role represents a logical, related grouping of functionality that represents a potential point of interaction. A role's definition is independent of the underlying implementation of that role. Roles can be thought of as a similar concept to software interfaces.

An object is a logical, related collection of data, and perhaps some business logic related to that data. This is an object in the software object-oriented sense of the word.

A Component is a software entity that provides implementation of one or more roles. It implements a substantial portion of business logic, and is the fundamental unit of configurability, extensibility, replaceability, and distribution. The implementation of a component is completely independent from the implementation of any other component.

In this document, we describe roles and objects. How those roles get mapped to components is to be specified when designing actual software components, or better yet, in a lower-level component architecture which guides how these fundamental pieces are formed into running systems.



3 Primary Roles and Objects

3.1 Transaction Participants

ROLES	OBJECTS
<ul style="list-style-type: none"> • Service Provider • Buyer 	<ul style="list-style-type: none"> • Service Provider Specification • Buyer Specification

Transaction Participants represent the participants of any one transaction (which may or may not be documented in a contract). In our model, every transaction will have at least one Buyer and at least one Service Provider. Any participant that buys a service or provides a service (whether it is free or not) must meet a **minimum set of responsibilities** within the E-Service Market Model. These minimum sets of responsibilities are defined in the Buyer and Service Provider roles.

It is important to remember that a software component can implement many roles. Each role simply defines a specific set of responsibilities. The Transaction Participant roles are important because they define the minimum set of requirements to participate in the E-Service Market Model.

The following provides an example of E-Service implementations that assume multiple roles:

A Mortgage E-Service has three participants: A Mortgage Broker E-Service, a Bank E-Service and a Credit Bureau E-Service.

- The Mortgage Broker E-Service assumes the Buyer role in its relationship with the Bank E-Service. It ALSO assumes the Broker role (*defined later in this document*).
- The Bank E-Service assumes the Service Provider role in its relationship with the Mortgage Broker E-Service, BUT assumes the Buyer role in its relationship with the Credit Bureau E-Service.

Notice from this example that participants may assume many different roles in a transaction, but all relationships come down to a Buyer and a Service Provider.

3.1.1 Service Provider

The Service Provider is the entity directly providing/selling an e-service. As such, the Service Provider possesses final responsibility for ensuring that the service is rendered as agreed upon. It has ultimate authority over all aspects of the e-service’s lifecycle, including e-service creation, compound service coordination, contract negotiation, fulfillment of services, etc. The Service Provider may potentially delegate some of these responsibilities, but it will be held solely responsible for any breaches in service.

Responsibilities	Collaborators
<ul style="list-style-type: none"> • Create Offers • May commission Advertiser to advertise Offer(s) • May commission Finder Agent to locate viable Request-For-Offers • Evaluate Request-For-Offers • Negotiate contracts for services (perhaps through an intermediary) • Enter into contracts to provide services • May negotiate and enter into contracts for brokered or auctioned services • Participate in service contract 	<ul style="list-style-type: none"> • Buyer • Service Provider • Advertiser Agent • Finder Agent • Negotiator • Broker • Auctioneer • Translator

<ul style="list-style-type: none"> • maintenance • Provide service specifications to Buyers • Participate in service initiation, interaction and termination • May present "current" QoS status/capabilities • May provide notifications to Buyers • Accept and act upon notifications from Buyers <p>Primarily provide automated services for programs</p>	
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3.1.2 Buyer

The Buyer is the entity directly consuming/purchasing the E-Service. The Buyer can represent humans or programs. The Buyer uses Request-For-Offers to specify the desired E-Service.

Responsibilities	Collaborators
<ul style="list-style-type: none"> • Create Requests-For-Offers • May commission Advertiser to advertise Request-For-Offers • May commission Finder Agent to locate viable Offers • Evaluate Offers • Negotiate contracts for services (perhaps through an intermediary) • Enter into contracts for services • May negotiate and enter into contracts for brokered or auctioned services • Negotiate access to services • Negotiate usage of services • Participate in service contract maintenance • Accept redirection to service providers • Accept service specifications from service providers • Participate in service initiation, interaction and termination • Accept and act upon notifications from service providers • Provide notifications to services providers • Participate on behalf of humans or programs 	<ul style="list-style-type: none"> • Service Provider • Finder Agent • Advertiser • Negotiator • Broker • Auctioneer • Translator

3.1.3 Service Provider Specification

A Service Provider Specification is a complete description of the Service Provider's characteristics and the functionality that it is capable of offering. A standard vocabulary and format is used so that core aspects of the specification can be universally understood. In addition, specialized vocabularies may be used to define domain specific features.

Responsibilities	Collaborators
<ul style="list-style-type: none"> • Interface specification • Initiation protocol specification 	<ul style="list-style-type: none"> •

<ul style="list-style-type: none"> • Interaction protocol specification • Termination protocol specification • Describes configurable attributes • Describes static assumptions • Dependencies upon Buyer configurable attributes • Buyer generated notifications <ul style="list-style-type: none"> • - Protocol specification • - Service Provider's responsibilities • Service Provider's generated notifications <ul style="list-style-type: none"> • - Protocol specification • - Buyer's responsibilities • Vocabulary Specification • Attribute Specification • Composition specification 	
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3.1.4 Buyer Specification

A Buyer Specification describes the Buyer's characteristics, including its functionality. For example, the Buyer will expose functionality that allows it to respond to notifications. It does not describe the service that the Buyer is requesting from the Service Provider; that definition is covered by the Request-For-Offer.

The functionality that the Buyer is willing to expose to the Service Provider may be specified in the Contract.

Responsibilities	Collaborators
<ul style="list-style-type: none"> • Describe Buyer's characteristics and functionality • Interface Specifications • Describe Static assumptions • Buyer generated notifications <ul style="list-style-type: none"> • - Protocol specification • - responsibilities 	<ul style="list-style-type: none"> •

3.2 Mediators

ROLES	OBJECTS
<ul style="list-style-type: none"> • Advertiser • Finder Agent • Broker • Auctioneer • Translator • Negotiator 	<ul style="list-style-type: none"> • Contract • Offer • Request-For-Offer (RFO) • Offer Registry • Request-For-Offer Registry • Contract Registry

Mediators are focused on forming a transaction agreement between Transaction Participants. The Mediator roles tend to be short-lived, since they are specific to any one transaction. The Mediator responsibilities can range from helping the Transaction Participants find each other to assisting with the negotiation of a contract.

3.2.1 Finder Agent

The Finder Agent role is focused on *finding* matches that satisfy its client’s needs. A client can be either a Buyer or a Service Provider. The Advertiser will advertise a Request-For-Offer (RFO) on behalf of a Buyer, whereas it will advertise Offer(s) on behalf of a Service Provider.

The Finder Agent role is short lived, in that it specifically searches on behalf of a single client (whether that be a Buyer or a Service Provider) for a single transaction. (A single instantiation of an implementation of that role may be used for many transactions, but each role is finished after a single transaction.) Once the match has been found, and an agreement has been made, then the Finder Agent’s role ends.

The Finder Agent can interface with other roles and objects to locate matches. It can search Offer Registries and Request-For-Offer Registries, or it can directly contact Brokers, Auctioneers, Buyers, Service Providers, or other Finder Agents. Finder Agents may vary in their sophistication, capabilities and effectiveness.

The Finder Agent may evaluate matches to determine which ones best satisfy the client’s requirements, and present only those to the client. The Finder Agent does NOT perform any negotiations on behalf of its client.

Once the matches have been identified, the Buyer and Service Provider perform negotiations, with the possible assistance of the Negotiator (see section 3.2.5).

Responsibilities	Collaborators
<ul style="list-style-type: none"> • Maintain reference to Registries of Request-For-Offers and E-Service Offers, Brokers, Auctioneers, Buyers, Service Providers or other Finder Agents • Search for Request-For-Offers or Offers • Match Request-For-Offers or Offers¹ • Present matches to client • Accept notifications (e.g. Registry state changes) • 	<ul style="list-style-type: none"> • Service Providers • Buyers • Brokers • Auctioneers • Translator • Offer Registry • Request-For-Offer Registry

3.2.2 Advertiser

The Advertiser creates and posts advertisements on behalf of its client. A client can be a Buyer or a Service Provider. The focus of the advertisement depends on the type of client being represented. For a Buyer, the Advertiser advertises Request-For-Offer(s), whereas for a Service Provider, the Advertiser advertises Offer(s).

Like the Finder Agent, the Advertiser role is short lived. It specifically advertises on behalf of a single client (whether that be a Buyer or a Service Provider). Once the match has been found, and an agreement has been made, then the Advertiser’s role ends. (Here again, a single instantiation of an implementation of that role may be used for many transactions)

The Advertiser can interface with other roles and objects to advertise for its client. It can advertise in Offer Registries and Request-For-Offer Registries, or it can directly contact Brokers, Auctioneers, Buyers, Service Providers, or Finder Agents

It is important to note that a Buyer or Service Provider Component can implement the role of the Advertiser and/or Finder Agent. The Component then performs the responsibilities that are defined by the role.

¹ Matching and negotiating are two distinct activities. Matching is about finding a potentially suitable pairing of buyer and seller. Negotiation is about ironing out the terms and conditions.

Responsibilities	Collaborators
<ul style="list-style-type: none"> • Maintain reference to Registries of Request-For-Offers and E-Service Offers, Brokers, Auctioneers, Buyers, Service Providers and Finder Agents • Advertise Request-For-Offers or Offers • Accept notifications (e.g. Registry state changes) 	<ul style="list-style-type: none"> • Service Providers • Buyers • Brokers • Auctioneers • Offer Registry • Request-For-Offer Registry • Finder Agent

3.2.3 Broker

The Broker manages and presents collections of Offers. Unlike the Advertiser or Finder Agent, the Broker does NOT act on behalf of any one Buyer or Service Provider. It simply offers a single location for Offers of a particular type and it provides some protocol(s) to help the Buyer select the best Offer.

For example, a Broker may specialize in car insurance for individuals who are accident prone. Finder Agents seeking this type of an Offer can take advantage of the Broker’s compilation of Offers that meet this kind of criteria. The “Broker” is very roughly equivalent to the well known e-business “Portal” concept in that it provides a location for buyers to go to find a set of related services, usually organized and filtered in some useful way. The biggest difference is that of scope. Where a “Portal” provides a human with a list of stores, each of which contain many items, the “Broker” provides an electronic buyer with a list of e-services.

The Broker may charge Finder Fees and/or Provider Fees. A Finder Fee is charged to the Buyer based on the successful match on a RFO. A Provider Fee is charged to an Service Provider for the registering of its Offers with the Broker. Other fee mechanisms may also be available.

The Broker does not participate in the negotiation process. It merely assists in the location of a match between an RFO and an Offer.

Responsibilities	Collaborators
<ul style="list-style-type: none"> • Accept Offers of a particular type • Maintain collections of Offers • Match Request-For-Offers with Offers • Present matches to client • Accept notifications (e.g. Registry state changes) 	<ul style="list-style-type: none"> • Finder Agents • Advertisers • Offer Registry • Request-For-Offer Registry

3.2.4 Auctioneer

The Auctioneer is another role that facilitates the discovery process. It handles the case where there are multiple Buyers for a single, high-demand service. The Auctioneer presents a single location for Request-For-Offers of a particular type (e.g. Beanie Baby Requests) and implements some specific auction protocol(s) to help the Service Provider select the best Request-For-Offer.

Similar to the Broker, the Auctioneer could make a profit by charging Finder Fees (on behalf of the Service Provider this time), Buyer Fees (the Buyers who register for a particular auction) or other fee models.

Like the Broker, the Auctioneer does not participate in the negotiation process. It merely assists in the location of a match between an RFO and an Offer.

Responsibilities	Collaborators
<ul style="list-style-type: none"> • Accept Request-For-Offers of a particular 	<ul style="list-style-type: none"> • Finder Agents

<ul style="list-style-type: none"> type • Maintain collections of Request-For-Offers • Match Offers with Request-For-Offers • Present matches to client • Accept notifications (e.g. Registry state changes) 	<ul style="list-style-type: none"> • Advertisers • Offer Registry • Request-For-Offer Registry
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3.2.5 Negotiator

A Negotiator brings two parties to an agreement, embodied in a Contract, that satisfies both parties. While the Buyer and Service Provider negotiate to their favor, the Negotiator plays a neutral role. The Negotiator uses the terms and conditions offered by a provider (as embodied in an Offer) and the terms and conditions desired by a buyer (as embodied in the Request for Offer) to see if an agreement can be reached. The Negotiator may act as a middle man, facilitating the bargaining between the Buyer and the Service Provider.

Negotiators may specialize in negotiations that are focused on a particular set of attributes and their trade-offs. For example, a Price-QOS Negotiator may help a Buyer and Service Provider come to an agreement on an acceptable balance of Price and QOS. A contract may be the result of negotiations that were facilitated by multiple specialized Negotiators.

Responsibilities	Collaborators
<ul style="list-style-type: none"> • Manage the Information, Agreement and Settlement phases of the negotiation. 	<ul style="list-style-type: none"> • Service Provider • Buyer • Negotiators • Service Specifications • Buyers Specification • Offers • Translator

3.2.6 Translator

A Translator² acts as a translator for units, vocabularies, etc. between two entities. For example, a Translator could be called upon to translate between European shoe sizes and American shoe sizes.

Responsibilities	Collaborators
<ul style="list-style-type: none"> • Translate attributes 	<ul style="list-style-type: none"> •

3.2.7 Contract

A Contract is a binding agreement between an Buyer and an Service Provider. It specifies terms and conditions that each side will fulfill. It must not exceed the bounds of the Buyer Specification or the Specification. The final version of a Contract can be held by both Transaction Participants or it can be registered in a well known location (e.g. a Directory dedicated to Contracts).

Responsibilities	Collaborators
<ul style="list-style-type: none"> • Maintain service specification • Maintain Buyer specification • Maintain terms and conditions of contract • Terms (preferred, required, negotiable) 	<ul style="list-style-type: none"> • Service ProviderBuyer

² Note that the use of the word "Translator" is not the same as the Translator pattern described in the Design Patterns book by Gamma, et.al.

<ul style="list-style-type: none"> and agreed): • - Method of service usage measurement • - Method of billing • - Method of payment • - Pricing mechanism • - Duration or amount of usage • - Exceptions (optional): conditions under which contract will not apply • Specify access to services • Specify usage of services • Recourse policy for violation • Involved parties¹ • Conditions (preferred, negotiable and agreed): • - Protocol usage • - Restrictions on protocol usage • - Restrictions on frequency of usage • Contracted configuration attributes for the Service and the Buyer • Recourse policy • Record involved parties 	
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3.2.8 Offer

An Offer is a representation of a set of terms and conditions that a Service Provider is offering. Offers are units of communication used during negotiation between buyer and seller. Offers can also be used as units of advertisement. It must not exceed the bounds of the Specification.

Responsibilities	Collaborators
<ul style="list-style-type: none"> • Provide description of service • Provide service advertisement • Provide offered service contract • Provide service reference • Indicates expiration of offer 	<ul style="list-style-type: none"> • BuyerService Provider

3.2.9 Request-For-Offer

A Buyer uses a Request-For-Proposal to announce that it is looking for a service. The Request-For-Proposal contains the specific details of the required service. An Agent, Broker or Auctioneer may try to match Service Provider Offers to a Buyer's Request-For-Proposals.

Responsibilities	Collaborators
<ul style="list-style-type: none"> • Indicate required attributes • Indicates expiration of request 	

3.2.10 Offer Registry

An Offer Registry provides access to a repository of Offers. An Offer Registry may or may not provide persistence.

Responsibilities	Collaborators
<ul style="list-style-type: none"> • Accept Offers • Manage, sort and filter Offers • Respond to Offer queries • Present Offers to requester • May provide persistence • 	<ul style="list-style-type: none"> • Offers •

3.2.11 Request-For-Offer Registry

A Request-For-Offer Registry provides access to a repository of Request-For-Offers. An Request-For-Offer Registry may or may not provide persistence.

Responsibilities	Collaborators
<ul style="list-style-type: none"> • Accept Request-For-Offers • Manage, sort and filter Request-For-Offers • Respond to Request-For-Offer queries • Present Request-For-Offer to requester • May provide persistence 	<ul style="list-style-type: none"> • Request-For-Offer •

3.2.12 Contract Registry

A Contract Registry provides access to a repository of Contracts. A Contract Registry may provide persistence.

Responsibilities	Collaborators
<ul style="list-style-type: none"> • Accept Request-For-Offers • Manage, sort and filter Request-For-Offers • Respond to Request-For-Offer queries • Present Request-For-Offer to requester • May provide persistence 	<ul style="list-style-type: none"> • Contract •

3.3 Market Makers

ROLES	OBJECTS
<ul style="list-style-type: none"> • Policy Maker • Advisor • Auditor • Insurer • Escrow Manager • Notary • Contract Enforcer • Contract Registry 	<ul style="list-style-type: none"> •

The Market Maker Element establishes trust in the market. This is essential, because without trust there will be no participation.

Each of the Roles within the Market Maker element addresses a specific aspect of trust. This allows the market to be customized to the situation. Simple e-services can use no Market Makers or can leverage the benefits of a simple

Advisor. More complex e-service transactions, on the other hand, can establish greater levels of trust by leveraging more of the Market Maker Roles and Objects.

Market Makers are longer-lived than Mediators, because they service many transactions. Market Makers can evolve over time, so that they can make more effective recommendations.

3.3.1 Policy Maker

The Policy maker defines the policies that a community follows. This can include business standards and practices (e.g. standards emerging from CommerceNet). It allows Buyers and Service Providers to establish transactions on set policies, raising the base level of expectations to the policy's standards.

Responsibilities	Collaborators
<ul style="list-style-type: none"> Maintain and provide community policies 	<ul style="list-style-type: none"> Buyer Service Provider

3.3.2 Advisor

The Advisor can provide ratings information or recommendations about both Buyers and Service Providers. This adds a level of sophistication to the discover process by allowing a Buyer or Provider the ability to eliminate matches that reportedly have a bad performance history.

Examples of Advisors include the Better Business Bureau, a Consumer Reporter or a Certifier of Reliability.

The Advisor can obtain performance information from various sources including Buyers, Sellers and Auditors.

Responsibilities	Collaborators
<ul style="list-style-type: none"> Maintain and provide performance information on Buyers and Providers 	<ul style="list-style-type: none"> Auditors Buyer Service Provider

3.3.3 Auditor

The Auditor gathers data on the performance of the Buyers and Sellers. The Auditor does not act on this information, but simply collects the performance data and presents it in an efficient manner. The Contract Enforcer (defined below) compares this data with the Contract in order to determine whether the contract is being met. The Maintenance Manager can leverage this information in order to identify or predict performance issues that need to be rectified.

Responsibilities	Collaborators
<ul style="list-style-type: none"> Monitor performance of Buyers and Sellers Manage and present performance data in an efficient manner 	<ul style="list-style-type: none"> Buyers Service Providers

3.3.4 Insurer

The Insurer provides guarantees of an outcome, by providing recourse if the terms of the contract are not fulfilled. The recourse can include remuneration or other methods of reimbursement. The cost for such insurance can vary.

Responsibilities	Collaborators
<ul style="list-style-type: none"> Provide guarantees of an outcome 	<ul style="list-style-type: none"> Buyer Service Provider Contract

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3.3.5 Escrow Manager

The Escrow Manager provides a neutral location where funds can be held until services have been rendered. The Escrow adds an element of guarantee that the service will be paid because the funds have been allocated to the Escrow Manager.

Responsibilities	Collaborators
<ul style="list-style-type: none"> • Manage escrow funds 	<ul style="list-style-type: none"> • Buyer • Service Provider

3.3.6 Notary

The Notary certifies contract signatures, thereby binding the agreement to both parties.

Responsibilities	Collaborators
<ul style="list-style-type: none"> • Certifies signatures on a contract • 	<ul style="list-style-type: none"> • Buyers • Service Providers • Contract

3.3.7 Contract Enforcer

The Contract Enforcer gets the performance data collected by the Auditor and compares it with the Contract (SLA's, etc) to see if the contract is being met. It raises alarms if the contract is being broken. It is up to the Buyer or Service Provider to then establish recourse for the contract infractions. Recourse can include a re-negotiation of the contract, remuneration or a collection of insurance.

Responsibilities	Collaborators
<ul style="list-style-type: none"> • Compare performance data collected by the Auditor with are Contract and notify the parties if the contract is not being met 	<ul style="list-style-type: none"> • Auditor • Contract • Service Providers • Buyers

3.3.8 Contract Registry

See Section 3.2.12 for definition..

3.4 Lifecycle Managers

ROLES	OBJECTS
<ul style="list-style-type: none"> • Composition Manager • Maintenance Manager • Fulfillment Manager 	<ul style="list-style-type: none"> •

The Lifecycle Managers are focused on managing the overall creation and maintenance of an E-Service. This includes the composition, provisioning, deployment, fulfillment and functional management responsibilities required for ensuring that an E-Service performs as expected.

3.4.1 Composition Manager

The Composition Manager is focused on the composition, provisioning and deployment aspects of an E-Service. It monitors the workflow, event management and transaction management across heterogeneous e-services to ensure that it functions seamlessly. Its primary goal is to manage the e-service so the composition aspects are invisible to the Buyer.

Responsibilities	Collaborators
<ul style="list-style-type: none"> • Know needed/required services • Manage composition/decomposition • Provision E-Service • Manage the workflow, events and extended transaction for the composed services • Direct compensation and exception handling 	<ul style="list-style-type: none"> • Service Providers • Contracts

3.4.2 Maintenance Manager

The Maintenance Manager ensures that the E-Services function appropriately. It uses data collected by the Auditor to identify performance issues or to predict performance issues. It then uses the data to raise alarms within the composite e-services or to rectify the situation.

Responsibilities	Collaborators
<ul style="list-style-type: none"> • Analyze data collected by Auditor and other sources to identify or predict performance issues • Raise alarm if there are performance issues • Correct performance situations 	<ul style="list-style-type: none"> • Auditor • Service Providers • Contracts

3.4.3 Fulfillment Manager

The Fulfillment Manager ensures that the service is fulfilled and delivered as agreed upon.

Responsibilities	Collaborators
<ul style="list-style-type: none"> • Ensure delivery of service 	<ul style="list-style-type: none"> • Auditor • Contract

3.5 Financial Managers

ROLES	OBJECTS
<ul style="list-style-type: none"> • Bid Manager • Billing Manager • Payment Manager • Escrow Manager 	<ul style="list-style-type: none"> •

The Financial Manager component provides the support roles related to the financial aspects of an E-Service. This includes the billing, payment, and funding aspects.

3.5.1 Bid Manager

The Bid Manager creates an estimate cost for the composite e-service. A guaranteed cost may not be possible, since the cost will often depend on usage. In response to the Service Provider's request to have an estimate of cost, the Bid Manager prepares a bid for the e-service. This is similar to the bids that general contractors make on home construction. The bid is generated using protocol(s) that estimate cost and usage by the various composed services.

Responsibilities	Collaborators
<ul style="list-style-type: none"> Establish overall composite bid for e-service Present bid to Buyer 	<ul style="list-style-type: none"> Service Provider Bid Manager (those of the composite e-services) Contract

3.5.2 Billing Manager

The Billing Manager handles all the billing procedures for an e-service. It collects, organizes and compiles the billing data from all the composed e-services into a single bill that is presented to the Buyer.

Responsibilities	Collaborators
<ul style="list-style-type: none"> Collect billing data from composed e-service Compile and organize billing data into a single bill Present billing data to Buyer 	<ul style="list-style-type: none"> Auditor Contract

3.5.3 Payment Manager

The Payment Manager handles secure payments between the Buyer and Service Provider.

Responsibilities	Collaborators
<ul style="list-style-type: none"> Manage payments between Buyer and Service Provider 	<ul style="list-style-type: none"> Billing Manager Contract Enforcer Contract

3.5.4 Escrow Manager

See Section 3.3.5 for definition of Escrow Manager.

4 Usage Diagrams

The diagrams below represent the five primary lifecycle phases for E-Service usage:

- Creation Phase
- Discovery (where the Service Provider and the Buyer discover each other),
- Negotiation and Contract Phase (where the Service Provider and the Buyer arrive at a contract), and
- Monitor and Manage Phase
- Fulfillment and Settlement Phase (where both parties fulfill the terms of the contract or else arrive at and fulfill settlement conditions)

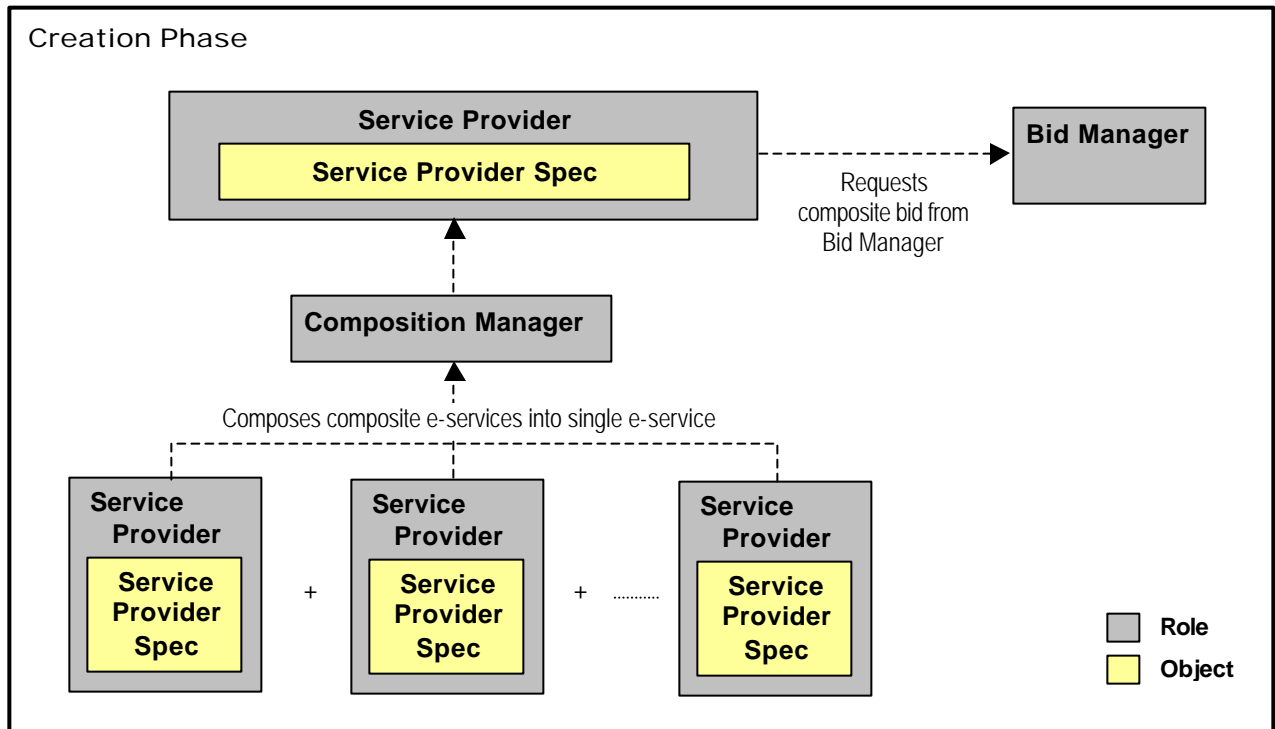
These diagrams are designed to present a high level snapshot of the relationship between the defined roles and objects. Detailed interaction and relationship diagrams will be provided once the models have been better defined.

The diagrams below assume that a composite service is represented by a single Service Provider. The relationship between any Buyer and an Service Provider is the same, regardless of whether the Service Provider is representing a composite service.

4.1.1 Creation Phase

The Creation Phase is focused primarily on the Service Provider. This is the phase where E-Services are composed, provisioned and deployed. The composition assumes that the Negotiation and Contracts have already been established for all the participant Service Providers. The Composition focuses on the overall workflow, event management and transaction management for the composed E-Service.

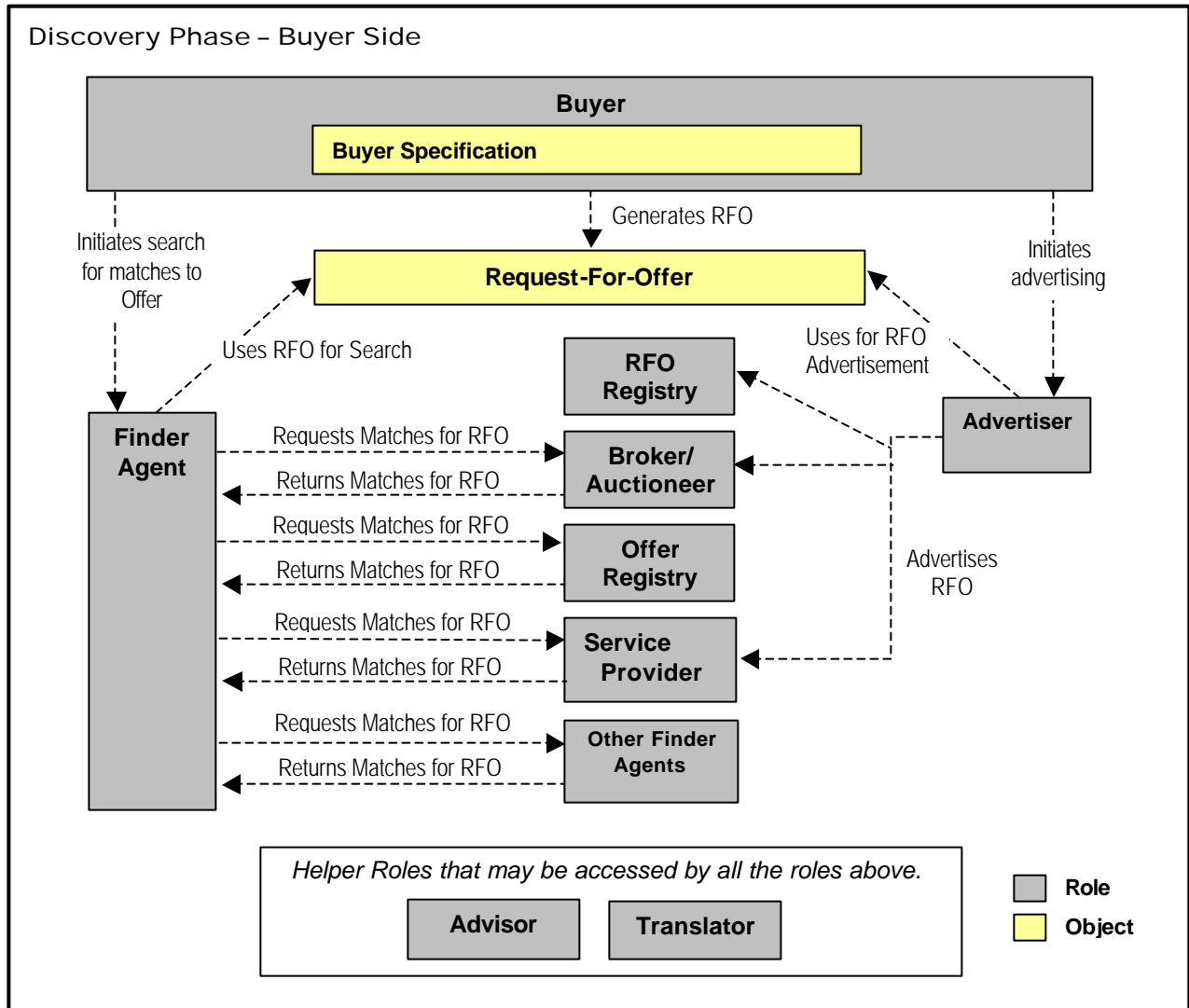
NOTE: The Creation Phase may not necessarily proceed the Negotiation and Contract Phase. For dynamic e-services, the Creation Phase may come after the requirements of the service have been specified in the contract.



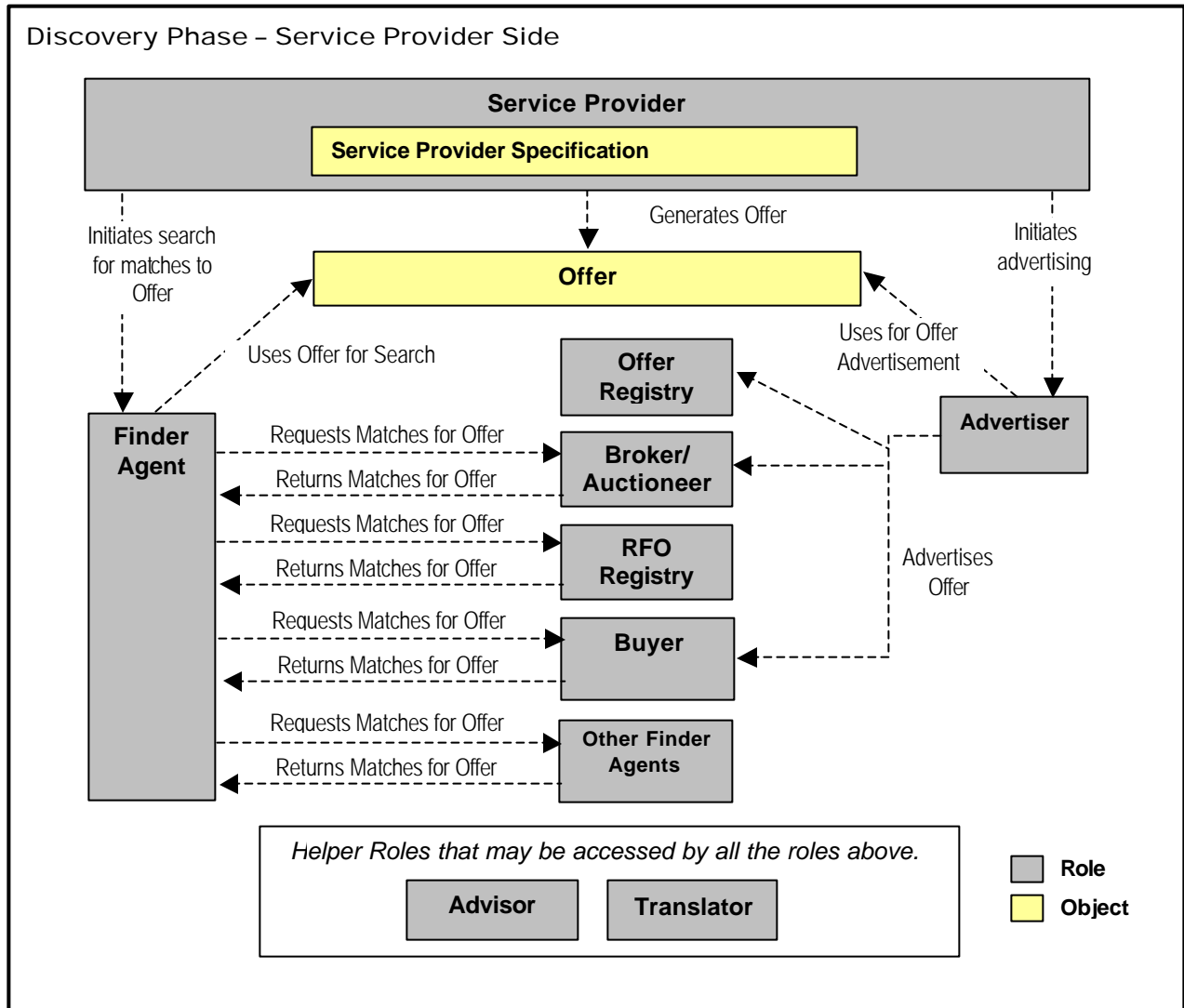
4.1.2 Discovery Phase

The goal of the Discovery Phase is to locate and establish the best match between a Buyer's Request-For-Offer and an Service Provider's E-Service Offer. We break these diagrams down into the Discovery Phase for the Buyer and the Discovery Phase for the Service Provider.

4.1.2.1 Discover Phase - Buyer Side

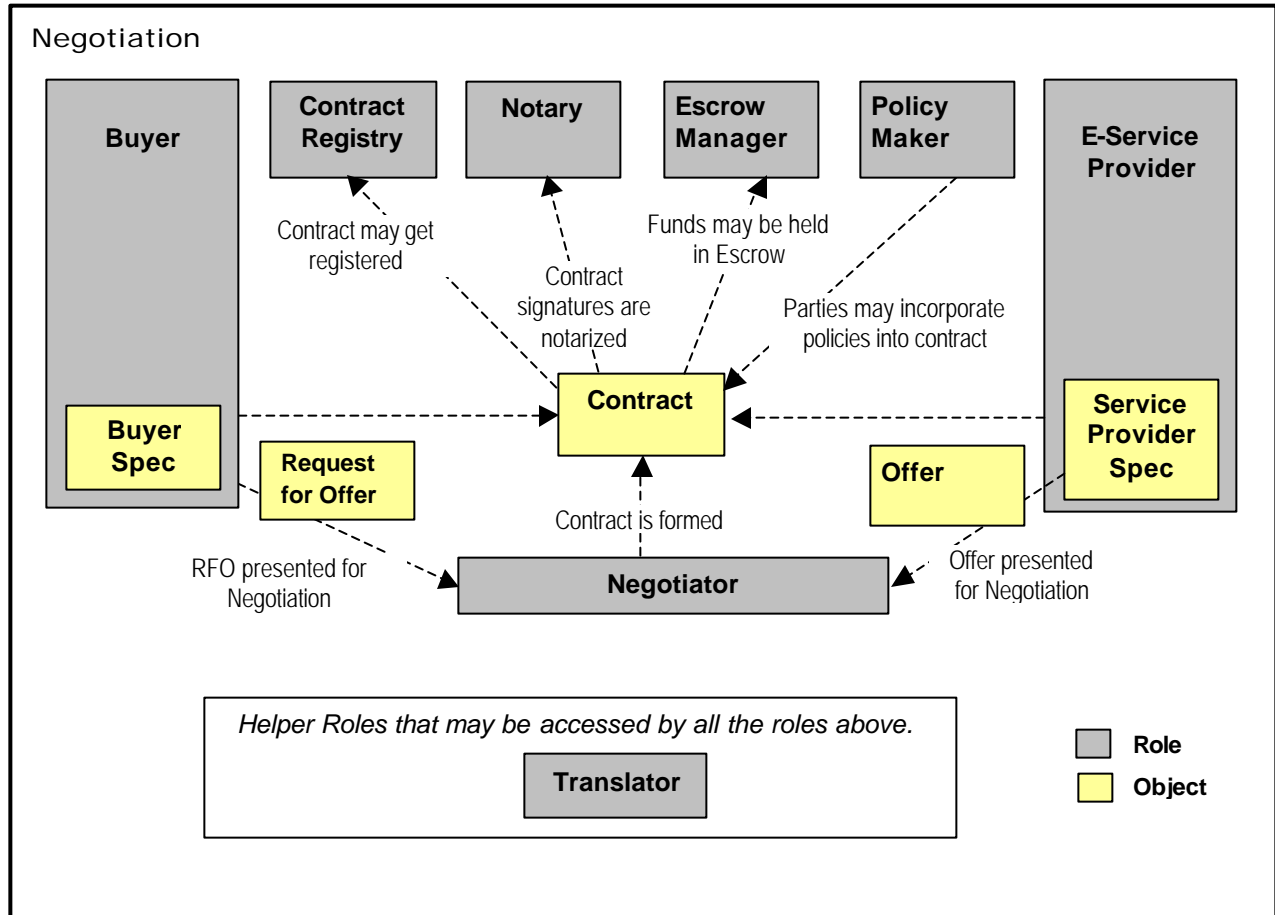


4.1.2.2 Discover Phase – Service Provider Side



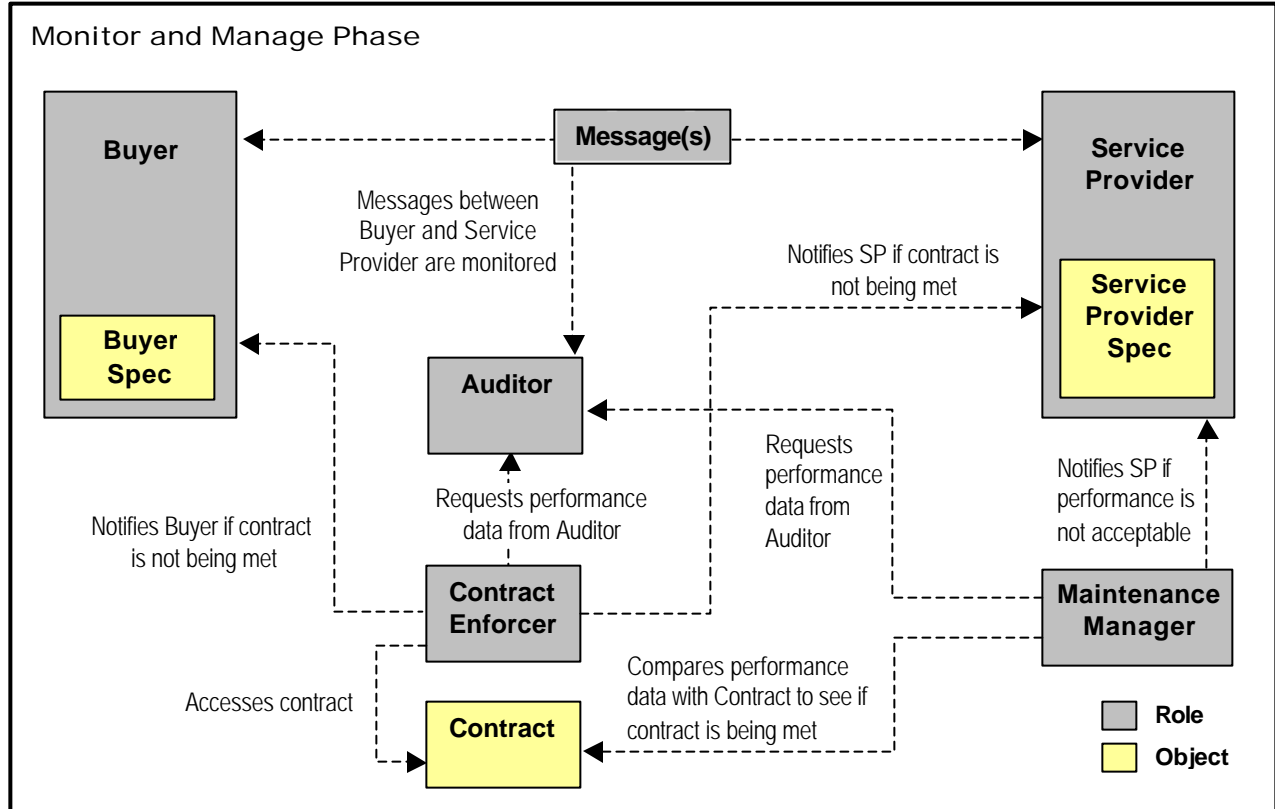
4.1.3 Negotiation and Contract Phase

The Negotiation and Contract Phase establishes a contract between an *Service Provider* and a *Buyer*. At this point in the lifecycle, it is assumed that a match between a *Request-For-Offer* and an *Offer* has been made. A match, however, only indicates compatibility between a *Request-For-Offer* and the *Service Offer*. The negotiations in the Negotiation Phase will determine whether the *Service Provider* and *Buyer* will bind themselves to a legal contract that specifies the *Buyer's* and *Service Provider's* responsibilities.



4.1.4 Monitor and Manage Phase

In the Monitor and Manage Phase, the performance of the service is monitored and managed. This is an optional phase, since some simple e-services may not require such complex policing.



4.1.5 Fulfillment and Settlement Phase

In this phase, both the *Buyer* and the *Service Provider* fulfill and settle their terms of the contract. If exceptions arise and the party(ies) can't fulfill the contract, then a re-negotiation of terms may occur. At the end of the contract, the relationship is terminated.

