

# A Business and Domain Model for Information Commerce<sup>1</sup>

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## Abstract

*The expansion of the Internet and its use in business and commerce has created a number of new business opportunities and a need for their supporting models. One of these opportunities may be classified as information commerce (i-commerce), a special case of e-commerce focused on the purchase and sale of information as a commodity. I-commerce may also be viewed as a special case of trading of intangible goods[1]. In this paper, we present a business and domain model for the emerging field of i-commerce. The model, called CIP (Customer-Intermediary-Provider), describes an information marketplace, a virtual environment in which buyers and sellers of information may trade information products. The purpose of the model is to clarify the issues involved in i-commerce, identify architectural requirements of i-commerce systems, and identify new services needed to support such architectures on the Internet. Such models are necessary for understanding and classifying the rapidly increasing information and service providers on the Internet. Indeed, the CIP model may be used to describe the functions and services of many existing and emerging Web-based services.*

## 1 Introduction

The Internet and the Worldwide Web have spurred the generation of a large amount of information and made possible its easy distribution over space, time, and in many forms and modes. But the ease of publishing and the universal availability of information have created several significant problems:

- The user is faced with an increasingly large number of information sources

- The producers and potential users of information are disconnected with no natural way of finding out about each other
- There is no simple way of assessing the dependability of information once it is located.

As a solution to these problems we envision an *information marketplace*, a virtual location where providers offer information and services as goods and customers have the ability to find, evaluate and buy the desired information. In this paper, we present the requirements of such a marketplace by defining a business model that identifies business actors, services provided by specific actors, activities and responsibilities of each actor, actor communication and coordination, and the artifacts produced. The model is focused on *information* as the commodity being traded. This model helps assess current businesses available on the Web and helps identify requirements for new businesses not yet available.

The Internet today represents a primitive instance of an information marketplace: it certainly does provide an environment for the location, distribution and sale of information. But this environment is complex and chaotic: there are an unknown number of actors with unclear responsibilities and new services are being developed and provided without clear concepts and business rules for their performance.

There are two approaches to defining a model for an information marketplace. One is to start with current models for the trading of tangible goods. This approach is taken by [1]. The alternative, taken in this paper, is to start with a minimal vision of the requirements of the information marketplace and derive the rules independently of the world of tangible goods. There are two motivations for starting from a clear slate: the business rules for information commerce are significantly different from those for tangible goods; and we need to

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discover new opportunities unencumbered by the restrictions imposed by the rules that are necessary for tangible goods. In section 3, we elaborate on other reasons for choosing to develop the model without reliance on models for tangible goods.

This paper presents a business and domain model for the information marketplace using the modeling language UML [2]. The model defines the goals and responsibilities of information customers, information providers and intermediaries. We therefore call the model Customer-Intermediary-Provider (CIP) model. Intermediaries provide services to both customers and providers and are the central contribution of the model. They locate, filter and combine the provided information and deliver the processed information to customers. The intermediaries add different levels and type of value to the information they receive from the providers.

To define a business and domain model for an emerging business is a challenging task. There are no experts to ask and there are no standards. But there are systematic approaches that one can follow. We have decided to follow the business modeling approach defined in [3] as a "technique for understanding the business processes of an organization."

The contribution of the paper is in providing a simple model for the emerging information marketplace with the goal of clarifying the significant issues and identifying potential new technical and business opportunities.

## 2 Information products

One of the strongest impacts of the Internet on society has been felt through its ability to make information available rapidly and widely. The worldwide web, which was initially conceived to make it possible for physicists to distribute and share their scientific results, is now the primary means of information communication and access for many. It is this impact that has finally caused an information revolution akin to the industrial revolution. There is little debate about characterizing the western world today as an information society.

If we consider the Internet as a platform for the distribution of information products, we can identify a wide variety of such products. Examples of such products are:

- Current price of a certain stock: this is a small piece of information that is of value if it is current and accurate and loses its value in a very short time as it becomes commonly available. Its value lasts a very short instance.
- A book in electronic form: this is perhaps a large piece of information that may be of value even in smaller granularities. For example, one can imagine buying a single chapter, or even a single paragraph of a book if offered electronically.

- A schedule of some type such as for a train or a movie theater: such information is also valid for a limited period of time but longer than a stock price.
- An image, a video, or a musical piece: these are perhaps timeless products.
- Software programs: these may be viewed as information products that embody algorithms that are able to perform a certain function or service.

The common denominator of these products is that they can be represented as bits of data. They are intangible and have no physical presence. Yet, they have intrinsic value and may be traded between producers and consumers just as tangible goods are. For this reason, it is important to define a business model for the trading of such information products.

## 3 Why start from scratch

There are two approaches to defining a model for an information marketplace. One is to start with current models for the trading of tangible goods. This approach is taken by [1]. The alternative, taken in this paper, is to start with a minimal vision of the requirements of the information marketplace and derive the rules independently of the world of tangible goods. Starting independently of the existing models helps us avoid the assumptions that are built in the existing models and may creep into our models unknowingly. Such hidden assumptions may become unnecessary legacy requirements. Avoiding such assumptions can help uncover new opportunities that are not possible in the tangible goods domain.

Some of the major differences between business requirements for information products and tangible products are:

- The principles of creating, printing, storing, copying, distributing, searching, and collating information are significantly different from that for tangible products.
- Information products are costly to produce, but cheap to reproduce and distribute; for tangible products, reproduction and distribution costs often overwhelm the cost of the initial product [4].
- Information products may retain their value for a very limited time, even seconds.
- Information products may lose their value over time but they may also have programmatic capability to evolve depending on their environment.
- Authentication and security issues are significantly different. Theft of a tangible product is rather obvious to the owner but theft of intangible products may remain undetected.
- Information products are amenable to automatic processing. Therefore, products may be further

processed or combined with other products to produce new products.

- Information products may be offered at many levels of granularity (e.g. a single sentence, a paragraph, a chapter, a whole book).

The significant differences between information products and tangible products lead us to expect that a different business model will be needed for information products. Despite the differences, it is possible to envision some products taking on both tangible and intangible forms. For example, books are currently primarily tangible products that are distributed in the familiar printed form but also in audio tape format. Several efforts are underway to make books into intangible products that may be downloaded as bits for a fee. Another example of such transformation from tangible to intangible is a transportation ticket. In the familiar tangible format, a ticket is a piece of paper that entitles the bearer to board a train or an airplane. In intangible form, it is simply a code known to the buyer and the seller. Such intangible "tickets" are now in use by several airlines and train companies. We consider them information products since they carry passenger and transportation related information that can be represented and used as a set of bits.

## 4 Business modeling for the information marketplace

Developing a business and domain model for an emerging market is a challenging task. It is certainly not a mechanical activity in which we are looking for a single answer. There are several proposals for approaching this task. We have decided to follow the business modeling approach defined in [3] as a "technique for understanding the business processes of an organization." In our case "an organization" is the information marketplace. The steps in this approach are:

1. Identify *use cases* in order to understand the context,
2. Describe each use case by identifying *actors*, *artifacts*, and *activities*,
3. Derive a *domain model* from use cases.

Use cases and use case diagrams are used for modeling the behavior of the system [2]. A use case diagram shows a set of use cases and actors, and their relationship. In the first step of the approach we employ use case diagrams for modeling the actors participating in business processes of the information marketplace.

The second step of the approach carefully investigates each use case. In this step a use case is described by a set of participating actors, a set of produced and used artifacts, and a sequence of performed activities. We use UML activity diagrams for modeling a number of possible activity sequences that form the information marketplace business process.

In the third step, the domain model is created on the basis of the results of the previous two steps. The domain model defines the entities involved in the business processes, and their relationship. The domain model is usually presented as a class diagram, where classes model actors and artifacts, and activities are transformed into methods. We use the domain model for describing the structure of the information marketplace. The CIP model therefore describes both the structure and the business processes of the marketplace by a class diagram and a set of activity diagrams identified in the previous step. We consider it a business model because it contains both structure and functionality descriptions.

We present the CIP model use case diagram, use case descriptions, and the domain model in the sequel.

### 4.1 Use case diagram

The first step of the modeling approach is the identification of actors who participate in the process of creating, distributing, and purchasing information over the Internet. By examining the simplest transactions on the Internet that may be characterized as activities in the information marketplace, we can identify a customer looking for a product and a provider that offers that product. The simple use case diagram relating the customer and the provider is shown in Figure 1. The two actors are the minimum number of actors needed to perform a transaction. We have identified two use cases that model the interactions between the actors: find a provider and supply product. These use cases model the minimum set of activities needed to enable a transaction. This use case diagram describes how the Web was used in its early days and how it is still used by many.

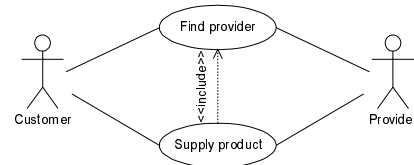
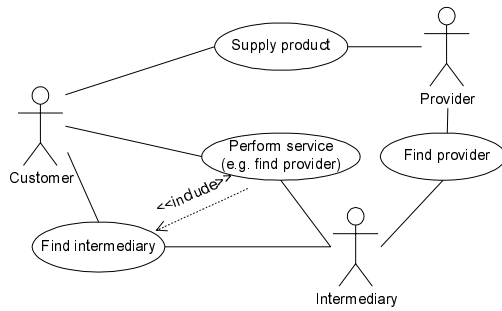


Figure 1. Use case diagram relating customer and provider

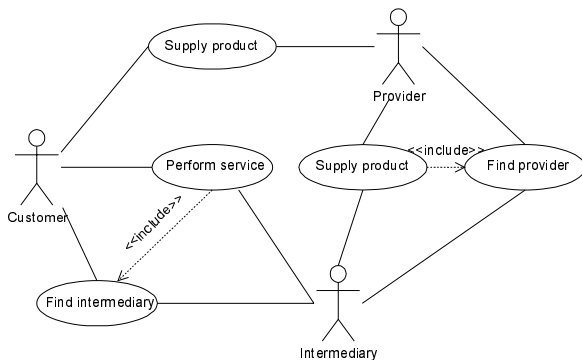
As the Web grew, both in the number of customers and in the number of providers, the activity "find a provider" grew in complexity. It used to be possible to remember the addresses of providers or write them in a notebook. Bookmarks served this purpose adequately for a while. To deal with the overwhelming increase in the number and variety of providers, a number of services and websites appeared that help the customer in finding providers. Search engines and portals are the best examples of such services. To take into account the key role of such sites in the interactions between customers and providers, we model another actor called *intermediary* and show the relevant use case diagram in Figure 2. The intermediary,

in this case, adopts the activity formerly performed by the customer and enables simple discovery of potential providers.



**Figure 2** Use case diagram relating customer, provider, and intermediary

Finding a provider is only one of the services an intermediary may perform. We envision the emergence of new intermediary services that will become part of the information marketplace business processes. The use case diagram in Figure 3 models such a situation. It relates a customer, a provider, and an intermediary performing a generic service. In our model, intermediary performs services for both customer and provider, and acts as a connection between them. Provider and intermediary participate in activities related to locating a provider and advertising its products. They exchange requests, orders, and offers in order to negotiate business terms related to delivery and payment. Customer uses the services offered by an intermediary to simplify its interactions with providers. However, provider and customer may still conduct business directly.



**Figure 3** Use case diagram of the CIP model

The diagram in Figure 3 depicts the business processes of the information marketplace at a high level of abstraction. It can be used to describe the transactions that are currently performed on the Web, as well as future, yet non-existing services. The intermediary is a central figure in this environment, offering services to both customers and providers. At this point we will not describe any particular service. A number of potential services are presented in section 5. First we describe each part of the CIP model use case diagram in detail.

The CIP model, as its name suggests, is based on the three actors that participate in the business processes of the information marketplace. These are customer, provider, and intermediary. The customer is an individual or an organization that requires a particular information product. The provider produces information products and sells them to customers. The intermediary is an organization offering services to both the customer and the provider.

We have identified the following use cases relating the customer, the intermediary, and the provider:

1. Supply product,
2. Find provider,
3. Find intermediary, and
4. Perform service.

The central use case is Supply product. It describes the basic activities of requesting, offering, ordering, and delivering an information product. Customer and provider, or intermediary and provider participate in this use case, since intermediary can also act as a customer. Supply product, therefore, describes the negotiating and purchasing activities between customer and provider, or intermediary and provider.

The use case Find provider models activities that enable an intermediary to locate a provider who offers an information product complying with specific intermediary needs. The use case takes into consideration that either the intermediary or the provider can initiate the business process. In other words, an intermediary can initiate the search for the provider, or the marketing efforts of the provider can induce the business relationship. The identification of the provider is a prerequisite for subsequent negotiation, order, and delivery of an information product and Find provider is therefore included in the Supply product use case.

The use case Find intermediary describes activities that enable a customer to locate an intermediary offering a desired service.

The use case Provide service is a generic use case describing a service an intermediary provides to its customers.

## 4.2 Description of use cases

The second step of the modeling approach is to develop a detailed description of the listed use cases. For each use case, we need to define the participating actors, produced and used artifacts, and performed activities.

Supply product describes the basic activities of requesting, offering, ordering, and delivering an information product. We assume that both the customer and the provider can initiate the business process. The customer starts the process by sending a request to the previously located provider, while the provider can initiate it by sending an offer to the customer.

Actors participating in the use case are the customer and the provider, or the intermediary and the provider. The difference between the customer and the intermediary, in this case, is in the purpose of obtaining the required information product. The intermediary uses the product for the subsequent business activities that provide information marketplace specific services. The customer, on the other hand, needs the information product for satisfying its goals, but its subsequent activities are not part of the marketplace-related activities.

Artifacts that are produced, modified, or used during the use case are the following:

- Request – customer initiates a request for a product by sending it to provider,
- Offer – provider answers the request by creating an offer,
- Order – customer places an order if it is satisfied with the offer, and
- Product – provider delivers the product to the customer.

The activity diagram in Figure 4 describes the business process performed during the Supply product use case

when the customer initiates the business process. It models the flow of activities of both the customer and the provider, and the result of these activities through object states.

The customer initiates the process by sending a request for information to the provider. We assume that the provider has been located previously, i.e. its identity is known and has been authenticated. After receiving the request, the provider analyzes it and can choose to create an offer or to reject the request.

After analyzing the offer, the customer can choose to accept or reject it. If the customer rejects an offer, the provider can either modify it, or stop the business process.

In the case the offer is acceptable, the customer places an order and waits for product delivery from the provider. The provider can, at this point, create the ordered information product and deliver it to the customer. Subsequent activities of receiving a product and billing a customer may be performed in parallel. Their completion invokes the process of payment. The provider finishes the process by closing the order.

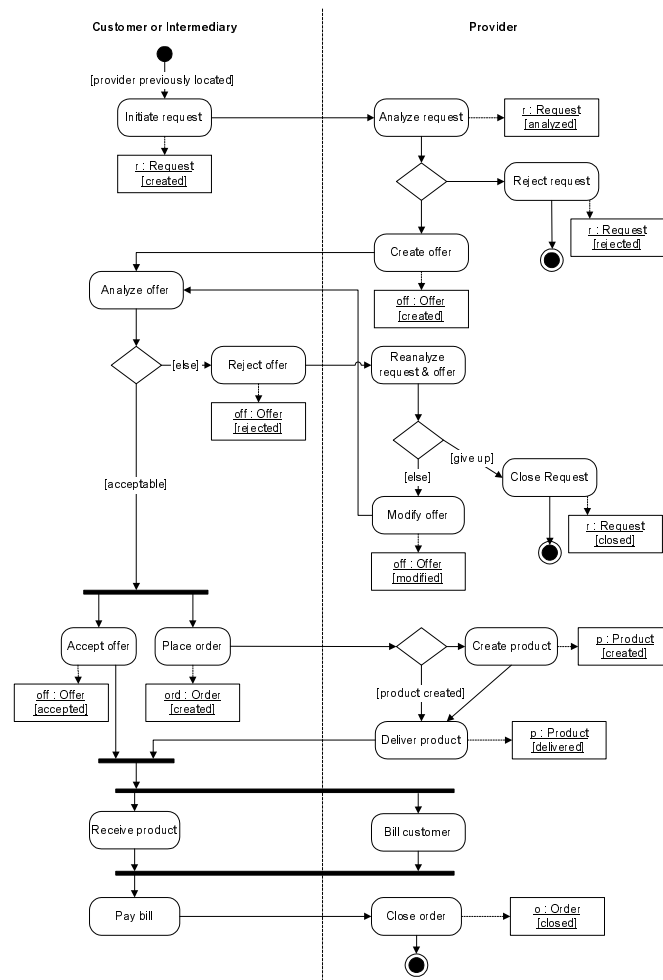
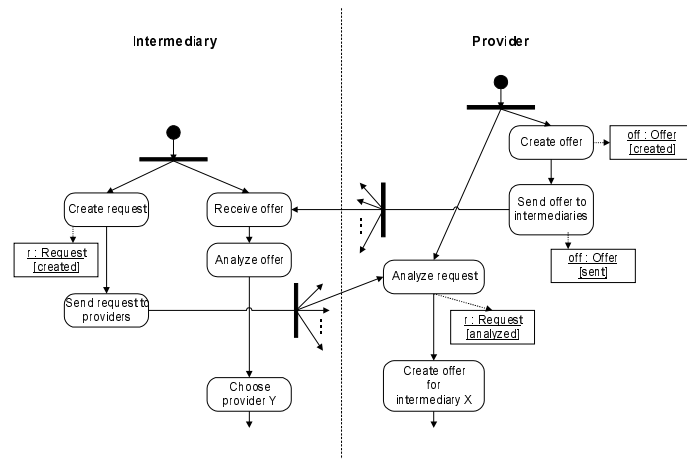


Figure 4 Activity diagram of the Supply product use case



**Figure 5** Activity diagram for the Find provider use case

A provider can also initiate the business process. In this case, the provider sends an offer to the customer who analyzes it and chooses either to accept or to reject it. The activity diagram for this case comprises similar activities to those presented in Figure 4, and is therefore omitted.

Find provider models the activities that enable an intermediary to locate a provider offering information products that comply with intermediary needs.

Actors participating in the use case are the intermediary and the provider. The intermediary looks for an adequate information provider, while the provider advertises its products.

Artifacts that are produced, modified, or used during the use case are the following:

- Request – specifies intermediary requirements regarding the needed information product, and
- Offer – specifies information products offered by the provider.

Request and offer are artifacts previously mentioned in the use case Supply product. The two artifacts are used for matching intermediary request to particular provider products. A precise request specification is needed for comparing the request to a product specification.

In this use case the intermediary tries to locate an adequate information provider. There are two possibilities for obtaining information about potential providers: by querying a number of potential providers or by receiving advertisements (offers) describing provider products. After obtaining the information about existing providers, the intermediary analyzes the collection and chooses the one for the business relationship. The described principle of locating the provider is depicted in Figure 5. The diagram shows the parallel flow of activities for both the intermediary and the provider. The intermediary can send requests to a number of potential providers, and in parallel receive and analyze incoming offers before choosing the provider for the business relationship. While advertising its products, the provider can send offers to a number of

potential customers, and at the same time analyze incoming requests. The activity diagram is left incomplete because the subsequent activities are part of the Supply product use case.

Find intermediary models the activities that enable a customer to locate an intermediary offering services that comply with customer needs.

Actors participating in the use case are the customer who looks for an adequate intermediary, and the intermediary advertising his services.

The process of locating an intermediary should be a simple activity if we assume that a successful intermediary creates a well-known trusted “brand” name. The process of finding an intermediary should be simpler than the process of locating a provider, and the number of intermediaries offering services on the Internet should be fewer than the number of information providers.

Provide service describes activities that enable an intermediary to provide a number of services to customers. Actors participating in the use case are the intermediary and the customer. The intermediary offers services to the customer and acts as a link between the customer and the provider. The customer requests a specific service from the intermediary. This use case is generic and can not be described in detail since each service brings its own requirements and particularities.

### 4.3 Domain model

The third and final step in business modeling process is to derive a domain model. The class diagram that represents the domain model of the information marketplace is given in Figure 6. It is created using the actors, artifacts and activities identified during the previous step of use case description. We define the Business Relationship class as an aggregation of actors and electronic documents that are exchanged among the actors.

Customer, intermediary, and provider, the actors of the information marketplace, are modeled using the *role pattern* defined in [4]. The role pattern models a *player* (actor in our case) with changing *roles*. The Actor class in the class diagram models an organization or a person taking different roles. Real roles of the information marketplace are modeled as Customer, Intermediary and Provider classes. They inherit the properties of Role, which is an abstract class.

Classes Request, Offer and Order model the corresponding artifacts. They inherit the properties of the abstract class Document since these artifacts can be regarded as electronic documents. Methods belonging to Document model the activities performed by customer, intermediary, or provider that change the state of the particular document. An important part of each document is the specification of the requested, offered, or ordered information product. Document is therefore associated with Specification, which specifies product features related to request, offer and order.

Actor is associated with Document since an actor creates a particular document and sends it to another actor for analysis. A customer can create requests and orders, a provider creates only offers, while intermediary may create requests, offers and orders.

A provider creates and owns a number of products. An association between Provider and Product models the stated relationship. Product is described by its specification: Product is therefore associated with Specification.

The association between Intermediary and Service describes the basic characteristic of an intermediary: providing a service. Service inherits the properties of Product. However, Product operations need to be overridden in Service, since the processes of creating and modifying a service are quite different from those for creating and modifying a product.

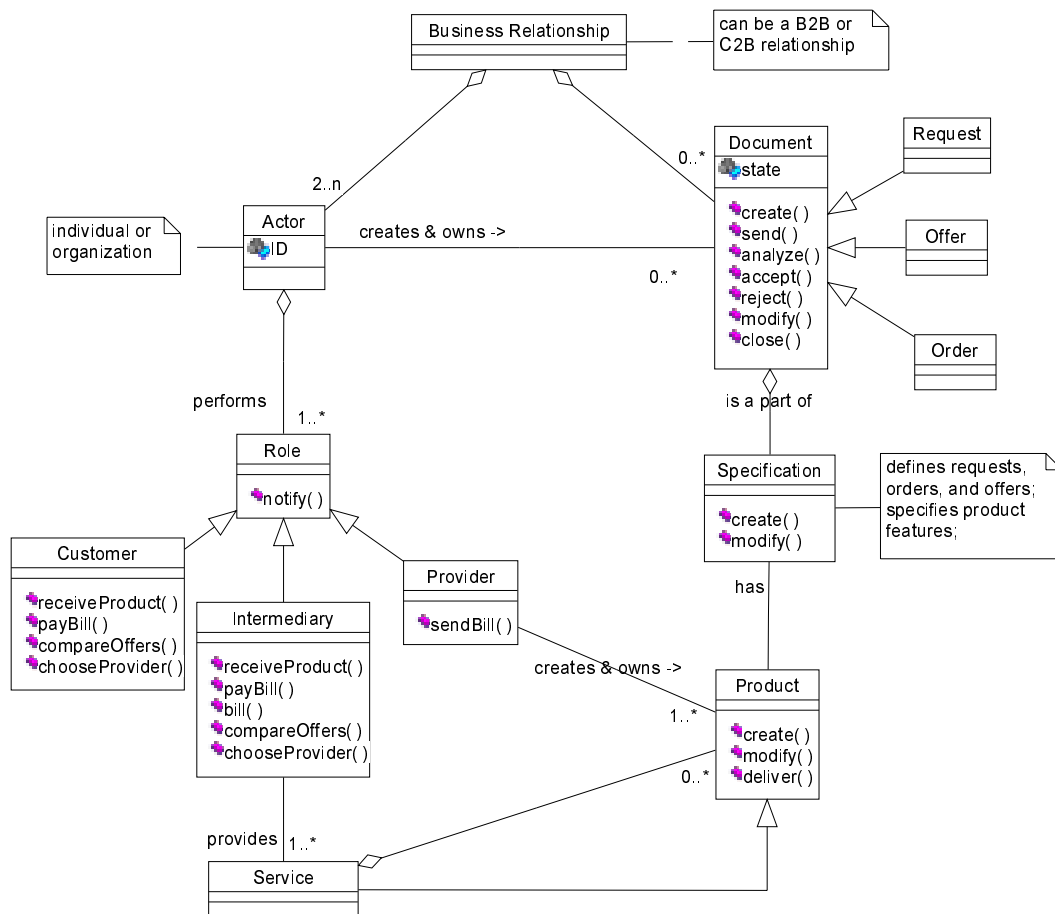


Figure 6 Domain model for the information marketplace

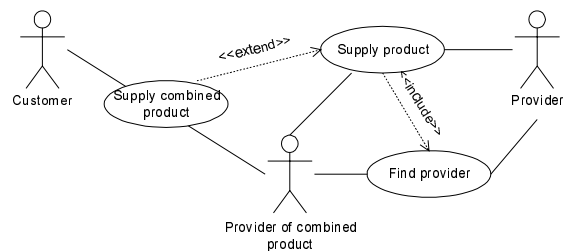
## 5 The many faces of the intermediary

The key actor in the CIP model is the intermediary. Search engines are perhaps the easiest example of intermediaries: they help customers find providers. Portal sites are another kind of intermediary: they classify the providers and help the customer's search based on the classification. But we can imagine many other services that may be performed by intermediaries. Indeed, an unlimited number of intermediaries may exist, each adding value to an information product in some way. With tangible products, each intermediary adds cost to the production and delivery costs of the end-product and, as a result, we tend to avoid introducing a large number of intermediaries. In the intangible goods marketplace, however, intermediaries add value without necessarily adding cost or delivery delays. From the customer's point of view, an intermediary is just a provider. From the point of view of the provider, an intermediary is a customer or a partner. This view is determined by how they arrange their business relationships.

By concentrating on the role of the intermediary, we can identify a number of services that either exist today or may be offered as new businesses. To help analyze intermediary services further, we can classify intermediaries in terms of their services. We have defined the following classes of intermediaries in our model:

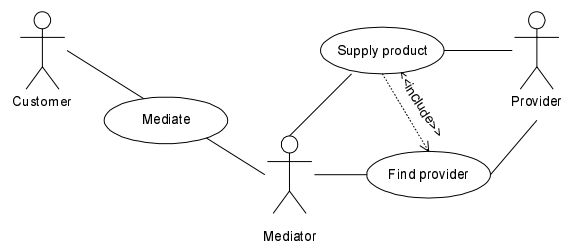
- **Classifying** (offered by portals): these intermediaries provide a classification of available providers.
- **Filtering**: these services provide a refined view of existing providers. For example, a digest service could provide a summary of information from other sites or a specialization service could provide specific information available from many providers (e.g. all performances of a particular symphony by Beethoven).
- **Qualifying**: these intermediaries could provide a qualification service. For example, a particular service could be to rate the reliability of information products available from other providers. Such a service could be used by customers to choose what providers they use and by providers to improve their services.
- **Authenticating**: these intermediaries could authenticate the identities of customers and providers.
- **Combining**: these intermediaries could combine the information products available from other providers. For example, an "evening planning service" could provide information about the starting time of an opera performance, the traffic conditions around the theater, and recommended restaurants.
- **Brokering** (offered by search engines): these intermediaries help customers and providers find each other.
- **Mediating**: These intermediaries help customers and providers transact a business. For example, a mediator could offer anonymous transactions so that the customer and the provider do not learn one another's identity. The difference between a broker and a mediator is that the broker helps in identifying customers and providers but the mediator helps in carrying out the process of a transaction between a customer and a provider.

Each intermediary provides a specific service that can be described by applying the modeling approach presented in section 4. For example, the use case diagram in Figure 7 depicts the service of combining information products. It is a special case of the generic use case diagram for the information marketplace, which is presented in Figure 3. In this diagram, Supply combined product models the activities of requesting, offering, ordering and delivering a combined product. Supply combined product is a modification of the Supply product since the negotiating process is the same for both use cases. They differ in the process of creating a combined information product.



**Figure 7 Combining**

The diagram in Figure 8 models the mediation service between a customer and a provider.



**Figure 8 Mediating**

The diagrams in Figures 7 and 8 are just the first step of the presented modeling approach. A complete model describing a particular service can be created following the subsequent modeling steps. The complete model needs to contain a detailed description of all identified use cases and a domain model relating actors, artifacts, and activities involved in the particular business process.

## 6 Uses of the CIP model

We have now shown the major parts of the CIP model for describing the information marketplace domain. There are three distinct uses for the model which we plan to explore in the future.

- The classification of the intermediary services may be used to design and offer new intermediary services and businesses.
- The different classes of intermediary services may be used to motivate the development of software tools that facilitate the building of those particular intermediaries. For example, we might consider tools that make it possible to build combining and filtering intermediaries rapidly.
- The classification of intermediaries may also be used to determine common services that could be used in the development of many intermediary services. Such common services should become part of the infrastructure of the Internet, or at least of the information marketplace.

## 7 Related work

Electronic commerce has been an active area of development in the last few years. Information commerce and information marketplace have been less mentioned but there are some books that cover the basics, e.g. [6]. The book [4] considers the relationship between traditional and digital economies and has many interesting observations about the relevance of traditional economic models to new information-oriented businesses.

Konstantas and Morin [1], which motivated our work, develops a model of commerce for digital goods on the basis of commerce for tangible goods. We have tried to follow an alternative approach, starting from the basic principles observable from processes that are being employed on the Internet.

Digital newspapers are examples of early information commerce businesses. Authors in [7] analyze and compare 48 existing digital newspapers. Some of them offer enhanced content when compared to their physical counterparts. New products include customized content tailored to individual customer, news archives covering certain period of time, and news incorporating audio and video clips (multimedia). The paper identifies a *market intermediary* as providing support for transactions between buyers and sellers. The listed products and services offered by digital newspapers can be viewed as intermediary services of the information marketplace. Customized content can be regarded as information filtering. News incorporating multimedia is an example of combining information products. Market intermediary is called mediator in our model.

Business modeling is in our view the description of organization structure and functionality. Some authors use

different definitions and approaches when presenting a business model. They concentrate on a special business case or type, as in [8], where business models for e-commerce are presented. Three main types of business models are identified and defined: *e-broker*, *manufacturer* and *auction*. In the e-broker model, the organization acts as a middleman between the supplier and buyer (amazon.com, abe.com). It adds no value to the product. In the manufacturer model, the organization adds value by developing the product from scratch, or by enhancing an existing product. In the auction model potential customers submit a bid, and the product is sold when the supplier accepts a bid.

According to [9] an e-commerce business model needs to describe the following issues:

- type of products, e.g. physical goods, digital products
- type of business, e.g. e-tailer, auction, e-mall, virtual storefront, brokerage system
- revenue-generating model, e.g. sales, subscription, advertisement
- business policies, e.g. privacy, pricing, intellectual property

Our model describes issues relating the sale of information products in an environment comprising numerous businesses that take the role of customer, provider, or intermediary. The type of the business, revenue-generating model, and business policies depend on the particular role, the information product being traded, and the provided service. Therefore, we can not discuss these issues in our model. In order to keep it simple and generic, we have omitted the description of payment. Existing payment models involve different activities and concerns, and need specific descriptions. If we consider payment as one of the intermediary services between a customer and a financial institution, our modeling approach can be used for describing each payment method in detail.

The CIP model has been developed as part of the OPELIX project which is developing models and a toolset for information commerce. CIP is an initial and generic model which is being refined further in the official OPELIX model. The official model has to meet the requirements of two of the partner companies that have specific information commerce requirements. Therefore, it will contain specific types of intermediaries. The web page [www.opelix.org](http://www.opelix.org) has some general information about the project.

## 8 Summary and conclusions

We have presented the CIP domain model of an information marketplace. The model consists of the three actors customer, intermediary, and provider, and the activities that relate these actors.

We had three goals in the development of the CIP model:

1. To define and understand the context of information commerce.
2. To help identify software tools and services needed to support information commerce.
3. To provide a framework in which web-based services can be classified and compared and new ones can be envisioned.

The key concept of intermediary in the CIP model may be used to understand the services provided by many web-based services today, envision new opportunities for information-based businesses, and identify software components and services that help both in building intermediary services and in conducting their businesses.

The CIP model provides a framework for the classification of actors in the information marketplace. We have given a classification of intermediaries and we expect that others will be able to refine the model by the addition of categories to the intermediary classifications and the definition of more specific intermediaries in each category. Such a refinement is taking place in the OPELIX project in which three applications from two companies are being used to define use cases and requirements for an information marketplace software toolset.

## Acknowledgments

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