

A Reference Model of Internet Service Provider Businesses

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Abstract

This paper presents a reference model of Internet businesses that facilitates the description of business models and business relationships of Internet service providers (ISP). The model also helps to understand the value proposition chain in the ISP market. The reference model is introduced by defining the basic roles that a business can play on the Internet. These basic roles are the building blocks of business models of ISPs and are essential to analyze the business relationships between ISPs.

We also examine some ISP business models, in order to demonstrate how ISPs address market niches by offering certain Internet services. The provisioning of these Internet services requires that ISPs establish business relationships with other ISPs. The analysis of these business relationships reveals important aspects of their business models.

1 Introduction

The analysis of the Internet is not sufficient anymore if it is solely based on the link state between routers (i.e. Internet topology analysis) ([1][4]). There are two main reasons. First, the Internet is becoming an integrated services network. More and more services are being introduced that require a better-than-best-effort network service quality. That means, in addition to the connectivity analysis, the performance of routes through the network has to be checked and maintained. Second, the requirements of Internet businesses have to be considered. The Internet has proliferated to a network that is trading products and services, worth several billions of dollars. In order to expand such trade, it is

necessary to have an infrastructure in place, which facilitates such business transactions. Information providers have to have a mean to communicate their needs to network providers, which transmit the information on their network to the consumer of the information provider. Only if this business relationship works, customers will be satisfied with the delivered service.

Examining the business relationships between some Internet companies, it becomes obvious that companies are already teaming up in order to deal with these problems. For example, Exodus specializes in data center services and reliable backbone services, helping other Internet companies to lower the risk of downtimes of their online information services. Another example is Akamai that supports content providers to speed up the content delivery to their consumers.

In order to address these business needs, an understanding of the business models of Internet companies is necessary. That means, beside the analysis of the Internet topology, the analysis of the business relationships between Internet companies as well as the value proposition of services is essential.

Greenstein ([2]) stated in his work that the value proposition chain for electronic commerce has not settled yet. Companies are still using different strategies for approaching similar commercial opportunities. Greenstein illustrated this situation by looking at the ISP market. He classified the ISPs into four groups: access service, backbone service, communication service, and consulting service. Lakelin, Martin, and Sherwood ([3]) give another ISP classification. They classified ISPs according to the size (i.e. local, national, and international) and the origin of the company (e.g. IT service, telecommunication service, new, cable service). However, both approaches are not detailed enough to express all the different ISP business models.

Therefore, we introduce a reference model that helps to describe business models and business relationships between Internet service providers. Based on that reference model, the place of Internet companies in the value proposition chains can be examined. The examination can be used help to determine where changes in the Internet have to take place in order to deal with future business requirements.

The remainder of this article is organized as follows. In the second section, the definition of roles that a company can play on the Internet is given. A short description of how those different roles can be executed is presented in the third section. The fourth section shows a model of possible business relationships between Internet companies. In section five and six, some examples of ISP business models are presented, demonstrating how existing ISPs focus on certain market niches by adding value to a bundle of purchased

Internet services. Finally, we close our article by giving a short evaluation in the last section.

2 Definitions of Roles of Stakeholders

A stakeholder on the Internet is defined as an abstract entity that could take on one or more roles and run them as a business.

The role of a stakeholder on the Internet can be classified according to different criteria. At the highest level of abstraction, the criterion is the position of the stakeholder in a business transaction. The business transaction is defined as the delivery of a service, which may or may not be free. Applying that, two roles of stakeholders can be identified:

- **Consumer:** A consumer (also named *Customer*) uses a set of services provided by one or more service providers. A consumer might be a person or a corporation.
- **Service Provider:** The stakeholder in this role will provide services for consumers. The type of service and the duration of the service might vary widely. The service may or may not necessarily use the Internet.

According to this classification, a consumer can also be in the service provider role, by reselling the service purchased (with or without adding value to it). Similarly, a service provider can be a consumer of a service it sells. In general, a stakeholder can always be in more than one role. It also might be that a stakeholder takes on a certain role in one business relationship and does not in another.

In order to distinguish those stakeholders in more detail, we classify the stakeholders according to the type of service they provide or consume. We suggest introducing two service layers reflecting two main types of services: the *Infrastructure Layer* and the *Internet Service Layer* (see Figure 1).

2.1 Internet Service Layer

The stakeholders of the Internet service layer are characterized by providing and consuming Internet services. An *Internet Service* is defined as a service that can be provided on the Internet. At this level of abstraction, the Internet service can be a network service (e.g. IP service, RSVP service) as well as an information service (e.g. stock market quotes). According to the definition of this layer, we determine three roles that a stakeholder of the Internet Service

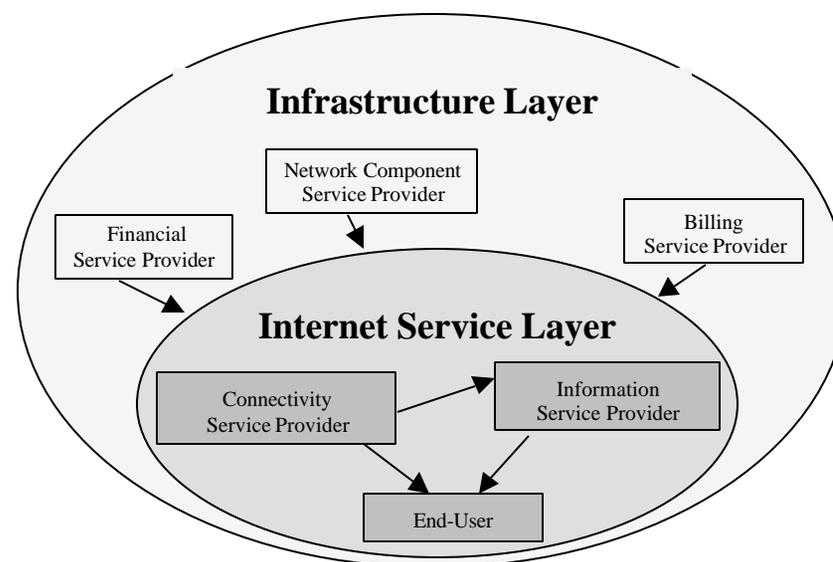


Figure 1. Service Provider Model

Layer can play. The roles are *Connectivity Service Provider*, *Information Service Provider*, and *End-User*. Stakeholders, who belong to the connectivity service provider or information service provider, are also called *Internet Service Providers*. The roles are defined as:

- **Connectivity Service Provider:** A connectivity service provider is a stakeholder who provides the means to forward IP data packets on its network. A connectivity provider can be an access provider, a backbone service provider, a data center provider, and an end-user network provider.
- **Information Service Provider:** The stakeholder in this role provides services on top of the network services provided by the connectivity service provider. An information service provider processes information and/or supplies consumers with information. Application service providers, content providers, Internet retailer, communication service providers, or market place provider belong to this class of service provider.
- **End-User:** In contrast to the definition of a consumer, an end-user is a consumer who does not resell a service, which it consumes.

In order to be able to describe the business relationship between information service providers, connectivity service providers, and end-user, a definition of roles within each of these groups of stakeholders is necessary.

2.1.1 Connectivity Service Provider

The connectivity service provider can be classified according to the functionality of the IP network within the Internet. Therefore, we can distinguish four types of connectivity service providers:

- **End-User Network Provider:** The stakeholder in this role can be the end-user itself or a corporation. The end-user is responsible for the network (e.g. a single PC or a LAN) or uses the network of a corporation she belongs to.
- **Access Service Provider:** An access service provider covers the 'last mile' between the end-user and the backbone, utilizing copper lines, fiber lines, or radio technologies. The DSL provider (e.g. AOL) and the local telephone companies (e.g. Pacific Bell or SBC), that provide the telephone line for connecting to the Internet via modem, are access service providers. Other examples of access service providers are mobile service providers (e.g. Vodafone) or wire-less service providers (e.g. @speed).
- **Backbone Service Provider:** A backbone service provider connects access providers to its high capacity network. Examples for backbone providers are AT&T, MCI Worldcom, British Telecom, Global Crossing, Qwest, and Level3.
- **Data Center Provider:** The role of this stakeholder is to provide a secure facility to information provider, guaranteeing high reliability and availability of their servers and high-speed connectivity to backbone providers. Examples of this kind of service provider are Exodus and Akamai.

2.1.2 Information Service Provider

Information service providers can be classified according to the kind of information they deliver. We distinguish five different roles that a stakeholder can take on:

- **Application Service Provider:** The service of an application service provider comprises the lease of usage time of software applications they own. The application software provider takes care of maintenance and management of the software. Examples of such applications SAP and FileMaker.

- **Content Provider:** Content providers collect, organize, and present information. There are content providers as, for instance, Marketwatch and CNN, which specialize on certain topics. Other content providers help people to find information quicker (e.g. Yahoo).
- **Internet Retailer:** A stakeholder in the role of an Internet retailer sells products on the Internet. Examples for product retailers are Amazon.com and Barnesandnoble.com.
- **Communication Service Provider:** The communication service provider offers services like Internet telephony, email, web-site hosting, or fax. Companies like Net2Phone, AOL, and efax.com belong to this group of Internet service providers.
- **Market Place Provider:** A market place provider operates and maintains an environment for service providers and consumers to offer, respectively, request services. In both cases, consumers can easily evaluate services. Examples of this kind of service provider BandX and RateXchange.

2.2 Infrastructure Layer

The infrastructure layer consists of all those providers that provide service to stakeholders of the Internet service layer, but do not directly conduct business in the Internet service layer. The service provided may or may not use the Internet. Some of the stakeholders that belong to the Infrastructure layer are:

- **Network Component Provider:** A stakeholder in the network component provider role owns network lines or computers, which it leases to other stakeholders. This stakeholder is not involved in any kind of data transmission.
- **Financial Service Provider:** A financial service provider provides a service for completing the money transfer. An example for such a stakeholder is a credit card company.
- **Billing Service Provider:** This stakeholder's role is to provide a billing service to stakeholders who outsource their billing of customers

3 Ways of Running a Role

Instead of provisioning the service themselves, stakeholders may just buy and exploit existing services. Three different ways of service exploitation can be distinguished: reselling services, adding value to services, and risk brokering services. Stakeholders who run their business in one of these ways are classified identical within the reference model as stakeholders with the same roles that

provision the service themselves. The way stakeholders run their roles is indifferent to the reference model.

3.1 Reselling Services

A reseller of Internet services buys a service and sells the exact same service to its customers under a different label. In many cases, the reseller is not even involved in any kind of service operation or service maintenance.

3.2 Adding Value to Services

Value-added service providers add value to a service by modifying or customizing a service for a certain customer group. The value-added service provider might have purchased or provisioned the basic service. The service can be of any kind, i.e. connectivity service or information service. An example of such a service provider is a communication service provider who adds portability support, tailored address directories, and/or authorization restriction to a basic email service.

3.3 Risk Brokering Services

A risk broker typically creates an insurance service for customers, which do not want to take the risk of changing prices or service qualities or the risk of service availability. The Risk broker charges for this kind of service a higher fee than the actual cost would be if no complications occur. The risk broker acts like an insurance company. The risk broker might be in the role of a connectivity service provider or an information service provider.

4 Model of ISP Business Relationships

The business relationship model describes possible relationships between Internet stakeholders. Possible business relationships between the connectivity service provider, the information service provider, and the end-user are presented in Figure 2. The black arrows represent the direction of the service delivery: $ISP_x @ ISP_y$ means ISP_x delivers service to ISP_y . The connectivity service provider might provide services to the information service provider, the end-user, and to other connectivity service provider. Information service providers only offer services to end-user and other information service provider. The end-user who does not resell services only consumes the services.

The interaction among each connectivity service provider is determined by the functionality that they are offering in the Internet. The end-user's network

is always connected to the access service provider's network, whereas the access service provider has at least one connection to the backbone. Data centers are located within the backbone (see black arrows within the connectivity provider box in Figure 2).

The information service providers are more flexible with regard to their business relationship among each other. All kinds of relationships are possible (represented by the circle in Figure 2).

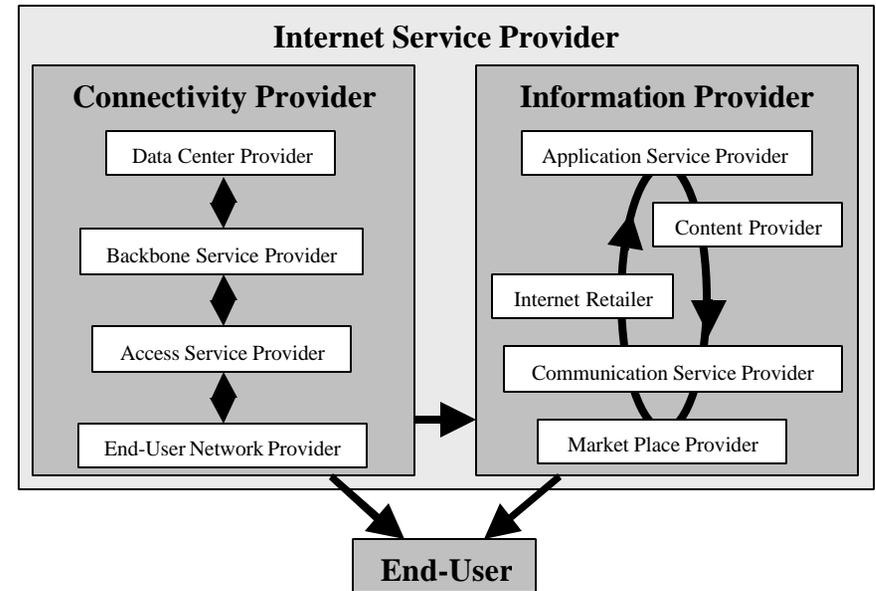


Figure 2. Internet Service Layer

The business relationship is characterized by the flow of value between stakeholders. The value flow is a combination of money flow and service flow. However, the money flow has not to be present. For example, an ISP delivers a service to a customer but does not get its revenue from this customer. Instead, its revenue comes from selling advertisement space on its web site. Nevertheless, it is necessary to exchange information about the service, in order to deliver the service properly.

This information exchange can be classified into the following classes: the exchange of charging information, the exchange of service provisioning

information, and the exchange of information about metered service (i.e. quantity and quality of service). Three examples illustrate that. The exchange of connection usage data might be necessary in order to collate accounting information between a local telecommunication company (i.e. access service provider) and a service bundling ISP if both share revenues (e.g. ISP market in Great Britain). The exchange of modem pool blocking data is interesting for an ISP in order to relate to overall QoS objectives. Metered IP traffic could be exchanged between backbone providers in order to decide on possible terms of interconnection agreements.

4.1 Money Flow

The revenue streams of ISPs vary widely. It is difficult to determine whether and how much money is transferred between two stakeholders in a business relationship. The direction of the money flow and the amount depends mainly on the market power of the ISP, i.e. the size of the network, the number of subscribers for the service, and the kind of service provided. However, in order to get an overview about possible revenue streams, we give some examples here:

- Backbone service providers get usage-based revenue from termination agreements with access service providers: Access service providers charge customers according to the time being connected to the network, and this charge is split between the access service provider and the backbone service provider.
- Revenue of an ISP with many subscribers might also come from agreements with Internet retailer and content providers connected directly to the ISPs network.
- Backbone providers' revenue streams depend on the size of their backbone network, the location of the network within the global network, and the nature of the information flow over the interconnection point.

4.2 Example of the Value Flow between ISPs

An example of possible business relationships between a generic ISP and other four stakeholders is shown in Figure 3. It is assumed that the generic ISP offers free email service and backbone connectivity to its residential end-users. End-users connect to the generic ISP's modem pool by using the local telephone service. The local telephone company is the access provider in this scenario. In addition to this, the generic ISP is supposed to have one single

backbone connection to the rest of the Internet. The generic ISP also teamed up with an Internet retailer for offering products to its customers.

The money flow of the generic ISP (shown in Figure 3) comes from the termination fee from the local telephone company, the advertisement placed on the its web-site from the Internet retailer, and the sales commission of the deals done by the Internet retailer. Since the generic ISP owns and manages its own network, it only has to pay for the backbone connectivity to the rest of the Internet.

The service flow of the generic ISP is reverse to the money flow in this example, except that there is an additional service flow to the generic ISP's customer. The end-users are getting the backbone connectivity service for free.

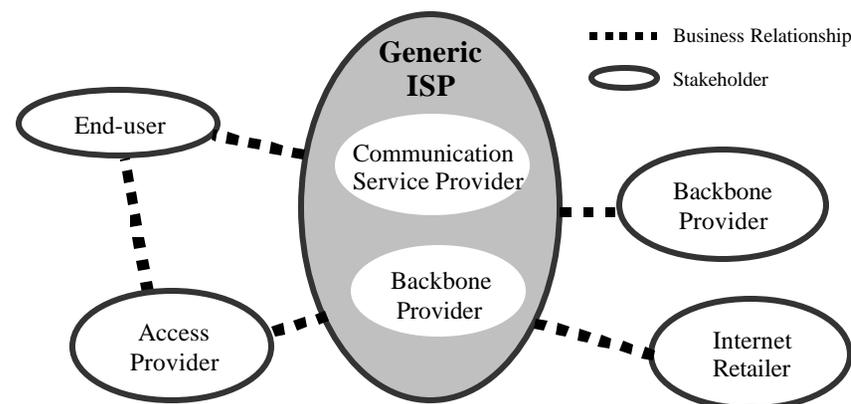


Figure 3. Example of the business relationships of a generic ISP

5 Paradigms of ISP Business Models

This section presents five business models of actual Internet service providers. After describing the business model of each company, we illustrate their business relationships in the terminology of the reference model. However, the illustration of the business relationships does not analyze the revenue streams of those ISPs because of the reason mentioned in the previous subsection. All data presented was gathered on May 1st, 2000.

5.1 Covad

Covad currently offers its Internet access services only in the USA, focusing on the major metropolitan areas. The revenues are \$66 million and the market capitalization is \$4189 million.

This company owns their own network, which includes an USA-wide backbone and the hardware equipment collocated at the ILEC central offices.

As of May 1st, 2000, Covad offers two DSL services, targeted at residential users and businesses. While the basic service comprises two choices (608/128kbps and 1500/384kbps), the business-targeted service offers six different choices between 144/144kbps and 1.1/1.1Mbps. The business services are further differentiated with regard to the number of users supported. In addition to this, Covad offers VPN service between company branches and headquarters as well as between company network and employees. The data between the Covad network and the company network is encrypted. However, Covad does not sell its products directly to end-users. The companies customers are Internet service provider like Mindspring / Earthlink.

In addition to this, Covad owns the subsidiary LaserLink.net that offers services to set up a virtual Internet service provider. Covad manages and administrates the network while the customer sells the service as its own (wholesale business).

The roles of the company in the business relationship to information provider are an access provider and backbone provider. In addition to this, Covad takes on roles as an access provider, a backbone provider, and a communication service provider in its wholesale business.

5.2 Mindspring / Earthlink

Mindspring is located in the USA and offers service in the USA and the United Kingdom. Its market capitalization is \$2400 million. The annualized revenues of \$1300 million are expected from 4.2 million subscriber accounts for backbone connectivity service and 148000 web-hosting accounts.

The network used is leased from Sprint and PSInet. Only the dial-up access sites in southern California are owned and operated by Mindspring / Earthlink.

The Internet access services cover a wide range of access technologies (e.g. dial-up modem, Frame-Relay, ISDN, or DSL) and access speeds. The price for modem dial-up service depends on the number of hours that a user wants to use the service. The prices on May 1st, 2000 ranged from \$6.95 for 5 hour/month (each additional hour costs \$2) to \$26.95 for unlimited access. This service is bundled with web space and a certain number of mailboxes.

The web-site hosting service provides an environment for enterprises to run a web site. The service comprises a fast reliable web server, POP email, CGI scripts, web statistics reporting, storage, an allowance of a certain amount of traffic to the web site (2Gbyte-6Gbyte; all additional traffic is charged at a rate of 0.04 – 0.1 \$/Mbytes), and an e-commerce software support. The web hosting service is actually split-up into four sub-services in order to address the need of different enterprises.

Regarding Mindspring / Earthling's business relationship with the end-user, the company takes on the roles as an access service provider, backbone provider, and a communication service provider. The company is in the role of a communication service provider because of its hosting services.

5.3 Exodus

Exodus focuses on the Internet data center market and owns a worldwide backbone. Its data centers are located in Asia, Australia, North America, and Europe (Sweden, United Kingdom, Germany, Netherlands, and France). The annual revenues are 242 million and the market capitalization is \$16900 million.

Exodus' services comprise the hosting of servers in a highly secure location, featuring raised floors, temperature control system, seismically braced racks, smoke detection, fire suppression system, motion sensors, and surveillance cameras. In addition to this, there are redundant power supplies, multiple backup power generators, and multiple fiber trunks coming into the data center. The connection speed between the customer's servers at the data center and the data center network can be 10Mbps Ethernet, 100Mbps Fast Ethernet, or 1Gbps Ethernet. Customers can also get multiple LAN connection in order to be fault tolerant against network connection failures. Exodus charges either a flat rate or a usage-based charge for those connections. In order to analyze the utilization of the connections, Exodus provides customers with a bandwidth report, containing detailed information about the line usage. In addition, it provides connectivity reports to the main ISPs and route information of IP packets.

Beside the data center, Exodus owns a backbone that connects all data centers redundantly, allowing single point-to-point fiber link failures. The company also offers Internet access services at T1 speed (1.54Mbps) and DS3 speed (45Mbps) for a flat rate or usage-based rate. Especially, they connect the customer's offices with the data centers.

With regard to Exodus' business with corporations, the company is in the role of an access provider. However, the main business is their data centers and backbone service.

5.4 America On-Line Inc.

AOL is a worldwide operating corporation, providing service in the United Kingdom (service name: AOL, Netscape Online), Germany (service name: AOL and CompuServe), and France (service name: AOL). The total customer base is 22 million. The current market capitalization is \$132000 million and the revenues are approximately \$4700 million.

AOL also bundles Internet connectivity services and information services. The connectivity service is a resale of connectivity service of Sprint, GTE Internetworking (formerly BBN Corporation), and MCI Worldcom Advanced Networks. AOL itself does not own any networks. Instead, AOL concentrates its efforts on providing content, retailing, and communication services to their customers. AOL has more than 1000 e-commerce and content partners. In many cases, AOL owns a stake in the partner's company. The company also wholly owns Digital City Inc (i.e. local content service provider), ICQ (i.e. chat communication service provider), MovieFone Inc (i.e. movie content service provider), and Spinner.com (i.e. music content service provider). That means, revenues of AOL come from the resale of the connectivity service, the advertisements placed on the AOL and Netscape Netcenter portal sites, and their communication service tools (e.g. AOL Instant Messenger, Net2Phone).

The roles played by AOL are access provider, backbone provider, communication service provider, Internet retailer, and content provider, considering AOL's business relationship with the end-user. The business relationship with connectivity providers puts AOL in the role of an information provider.

5.5 Akamai

Akamai is an Internet service provider that offers services to content provider guaranteeing fast and reliable delivery of content to end-users. The company is based in the USA but operates worldwide.

In order to be able to offer such a reliable and fast service, Akamai distributed 4000 cache servers to the edge of the Internet worldwide, addressing two issues. First, routing of content via various paths between their servers becomes possible even if few parts of the network are congested or out of service. To detect such network failures, real-time information about the network is constantly analyzed by fault tolerance software. Second, servers are always physically closed to end-users, resulting in short responds times to end-users content requests and high bandwidth availability to the users computer. This approach enables the delivery of contents with better quality than the best-effort quality of today's Internet.

Especially, Akamai focuses on certain content type. It offers streaming media service, including live events, continuous broadcasts, and on-demand media. Beside their server technology, Akamai uses forward error correcting software and multiple copies of streams to guarantee the delivery of the content to all their servers at the edges of the Internet.

Akamai has business relationships with content providers, backbone provider, and access providers. The company has to rent space for their cache servers in the central offices of the access provider and connect them to the network of the access provider. It also has to connect their servers to several backbone networks. The service agreement with content providers has to specify the kind of content, which has to be cached. Akamai's roles are a data center provider and an application service provider. The company takes on the role of a data center provider since it owns cache servers. Since the company runs software to distribute the content, it is also in the role of an application service provider.

6 Comparison of ISP Business Models

A recapitulation of the ISPs business models described in the previous sections is given in the following table. It shows the roles X that each ISP takes on with regard to their customers. (X) represents a role, which is run as a reseller.

Role	AOL	Mindspring	Covad	Exodus	Akamai
Access	(X)	(X)	X	(X)	---
Backbone	(X)	(X)	X	X	---
Data Center	---	(X)	---	X	X
Application	---	---	---	---	X
Content	X and (X)	---	---	---	---
Retailer	X and (X)	(X)	---	---	---
Communication	X	X	---	---	---

Table 1. Summary of ISP roles

Considering these examples of ISP businesses, it becomes obvious that today's ISPs are focusing on certain roles they want to take on. For example,

Covad addresses the high-speed access market. Akamai and Exodus offer data center services. Mindspring provide communication services for the residential market. AOL delivers content services, communication services, and retail services.

In addition to this, the business models of these ISPs can be characterized even further by examining their customers, the addressed needs of their customer, and the kind of service that they own. Covad sells its services only to reselling ISPs like AOL and Mindspring. Exodus and Akamai are addressing the need of information service providers to deliver their information reliable and fast. Akamai offers specialized services for fast content and streaming media delivery. Exodus offers a highly secured and reliable backbone and data center service. Both companies' technology helps to provide better-than-best-effort service on the Internet. AOL's and Mindspring's customers are residential end-users. Both companies' basic service is access service and backbone service. However, AOL focuses on the provision of content to customers, which is owned by AOL or third party ISPs. Mindspring's differentiating service is web site hosting. The following table summarizes these facts (see Table 2).

	AOL	Mindspring	Covad	Exodus	Akamai
Customer	Residential End-Users	Residential End-Users	Business Customers	Business End-Users	Business End-Users
Addressed Needs of Customers	Backbone Connectivity and Content	Backbone Connectivity and Hosting	Broadband Access and VPN	Reliable Information Delivery	Fast Content and Streaming Media Delivery
Roles (Own Services)	Content and Communication	Web-Site Hosting and Communication	Access and Backbone	Backbone and Data Centers	Data Centers
Roles – (Resell Services)	Access and Backbone	Access, Data Center, and Backbone	---	Broadband Access	---

Table 2. Characterization of ISPs' business models

Table 2 shows clearly that these ISPs go for certain market segments. The ISPs distinguish themselves by addressing certain needs of customers. This helps them to stay competitive. For example, since the merger between AOL and Time Warner, AOL focuses even more on the content provision to their customers. AOL intends to become a media player, offering all kind of

entertainment. Mindspring tries to attract customers by offering web site hosting service services, which becomes more and more attractive to end-users. Covad is in the broadband access market. Exodus and Akamai are focusing on the data center market, although applying different technologies.

7 Conclusions

We introduced a reference model that helps to analyze business models of Internet businesses. The model facilitates the description of business models and business relationships of Internet service providers.

The reference model defines different kind of roles that an ISP can take on in the Internet. The basic classes we distinguished are roles as a connectivity service provider or an information service provider. Roles as a connectivity service provider are end-user network provider, access service provider, backbone service provider, and data center provider. The information service provider roles are Internet retailer, content provider, application service provider, communication service provider, and market place provider. Based on the definitions of these roles, we defined a model of ISP business relationships.

In the second part of the paper, we used the model to analyze five ISP businesses (AOL, Mindspring, Covad, Exodus, and Akamai). We showed how these companies focus on certain market segments in the Internet service provider market.

Our future work will use this model to analyze pricing plans of ISPs. Especially, we want to investigate the impact of pricing plans on the value flow as part of the ISP business relationships.

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