Market Managed Multi-service Internet

M3I

European Fifth Framework Project IST-1999-11429

Deliverable 7.1
ISP Business Model Report

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Document Control

Title: ISP Business Model Report

Type: Public Deliverable

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Origin: RC-AUEB

Doc ID: m3i:m3idel07_1

Amendment History

Version	Date	Author	Description/Comments
V 1.0	20-Dec-2000	AUEB	First published version
V1.1	31-Jan-2000	HPLB	Formatting and language edit only
V1.11	04-Feb-2002	HPLB	Released as Public document

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1 Introduction

Recent research work on Internet Economics has been focused on detecting congested areas and on analysing traffic patterns according to the Internet physical topology. Further work examined the connectivity between autonomous systems in the Internet. This kind of analysis provided useful insights on understanding how a network owned by one organization became a network of more than 8000 owners. The results have been used either to improve the overall communication performance of the Internet or to introduce efficient resource allocation mechanisms.

However, the analysis of the Internet based solely on the physical topology is not sufficient any more. There are two main reasons. Firstly, the Internet becomes an integrated services network. The new services and applications have specific quality requirements, which are not covered by-best-effort network service. Secondly, the requirements of Internet businesses become the driving force for technological developments. The Internet proliferated to a network that is used for trading products and services, and generating high revenues. Internet companies are focusing on demand patterns and customer needs. Customers are expecting the Internet to provide reliable and highly available network services.

The existing business relationships between the Internet key players indicate that parts of the Internet are optimised to deal with the emerging business requirements. Currently new entrants appeared in the Internet marketplace, specializing in reliable backbone network services, or supporting other Internet companies to lower the risk of downtimes of their online information services. At the same time, content providers are teaming up with backbone providers to speed up the content delivery to their consumers.

In order to address new business requirements, understanding of current Internet business models is necessary. This will also provide further insight on business relationships between the key players as well as the value chain of service delivery to the end user.

The market analysis of Internet Service Provider (ISP) businesses will facilitate understanding of their current needs as well as evaluating the impact of M3I technology on their current business models. Special, emphasis is given on the following two questions: will M3I technologies increase the revenue and improve the positioning of an ISP in the Internet marketplace?; what type of new functions could be introduced in future ISP business models?

A more detailed analysis of possible future ISP business models is presented in Deliverable 7.2. That deliverable uses the market analysis results of Deliverable 7.1 in order to examine whether dynamic pricing will proved to be useful for the ISP business. Deliverable 7.2 describes scenarios that are addressing certain issues, such as how an ISP may provide stable prices to the end user on a dynamic-priced network and whether end-users are able accept a market-managed network.

The report starts by presenting the structure of the Internet marketplace and the key stakeholders. The analysis of stakeholders leads to selecting five ISPs' paradigms (AOL, Mindspring/Earthlink, Covad, Exodus and Akamai). After describing their business objectives and strategies, the study then presents business relationships and value flows, which form the business models. Having described current situation, the study presents macro trends in the Internet marketplace, by focusing on emerging business opportunities and fundamental changes due to technology evolution. A brief description of the impact from UMTS deployment on Internet stakeholders is included.

Finally, M3I new services and roles are introduced and analysed in the context of the Internet marketplace.

2 Construction of the Reference Business Model

2.1 Objectives and Scope

The objective of this study is to describe business relationships in the Internet, and model those ones between an ISP and other Internet stakeholders in order to provide further insight on new Internet services. A key issue of this study is the ability to specify the technical and business requirements of the various services in terms of some simpler set of services. Such simpler services might include the transport service (differentiated in terms of quality), the accounting service (measuring several aspects of the service), or the charging service (reverse charging, billing). Then, the study examines whether such a set of simple services is adequate to synthesize the targeted set of valued-added services that network service providers will deploy.

The modelling perspective is based on analysis of the differences between the current situation in the Internet marketplace and the projected situation following market dynamics and technological evolution.

The current situation is captured in today's ISPs business models. The analysis of current business models comprises the relationships developed between key players according to their business objective. These findings are used to identify current value flows among players and to depict the value chain of service delivery. The current business models capture relationships and exchanges (money flows) in the marketplace in which M3I is going to be introduced.

The analysis is based on a reference model governing the relationships and exchanges among players (business entities) in the Internet marketplace. The reference model illustrates the following:

- Specification of the basic business entities (customer, ISP, access provider);
- Specification of the existing business relationships and the value flows;
- Specification of the current types of Service Level Agreements (SLAs);
- Description of the set of generic services and technologies required for providing the new services.

The study then presents emerging business opportunities and technology advances that are influencing the evolution of Internet marketplace, thus the ISP core business. Special emphasis is given on the impact of Universal Multimedia Technology Systems (UMTS) on the Internet marketplace. Finally, according to the description of the M3I technology framework, which dictates the technological capabilities to be offered by the system, M3I new roles and services are introduced in the Internet marketplace.

2.2 Method of Work

This part outlines the various analytical tools employed in this deliverable in order to construct the reference business model and analyse Internet marketplace. The work done is presented as the sequence of the following steps:

1. ***Identification of stakeholders and their business relationships in the Internet marketplace.*** The theoretical basis of the work is the identification of the relevant stakeholders [6]. The M3I partners have provided input on the nature and content of business relationships they currently have in the market, thus supplying a representative perspective for each stakeholder. Information on the stakeholder perspective has been obtained through workshops with M3I key users and has been supported by supplementary market analysis material
2. ***Presentation of key players and their business objectives.*** Specific ISP paradigms have been identified according to their importance in the Internet marketplace. The goals of the ISPs under consideration are analysed based on Internet Economics and Industrial Organisation literature. The findings have been verified through discussions with the M3I key users.
3. ***Analysis of money flows in the marketplace.*** A marketplace is the collection of a series of bilateral relationships between industries participating in the creation of value in a field of economic activity [7]. Each bilateral relationship between two different industries defines a market [8] (e.g. the relationship between an access provider and a backbone provider is the network services market). Each industry in a marketplace comprises different types of companies depending on the scope of their activities (i.e. degree of vertical or horizontal integration) [8]. The concept of the marketplace is utilised in order to establish the total value created by all participating players within the scope of the M3I project.
4. ***Description of key players' business models.*** Having presented the key ISP players a detailed analysis of their business relationships with other stakeholders is introduced in order to describe their business models.
5. ***Identification of key competitive drivers in the market.*** Depending on the range of activities of each stakeholder, the amount of information created changes its competitive position within the marketplace. The main drivers of competitiveness of the Internet marketplace, in which M3I architecture is going to be introduced, are identified. This provides the analytical framework of market development and identification of business opportunities. Internet marketplace is evolving mainly due to market pull. Finally, UMTS business opportunities for the Internet stakeholders are presented.
6. ***Introduction of the M3I new roles and services.*** The functional behaviour of the new roles in the marketplace is specified in order then to justify their presence in value-adding terms. Information from Task 2 "Requirements specifications" [31] was used in order to identify all inter-organisational processes (i.e. the processes crossing the boundaries of individual key players) in the marketplace and provide a list of their potential services. At the same time these services have been linked to the main beneficiaries among existing players.
7. ***The impact of M3I technology on the ISP market.*** M3I technology will bring technology advances in the ISP market. It will enable ISPs to highly customise

their services and to offer more sophisticated pricing of their services. M3I technology aims to provide a set of generic pricing, accounting and charging mechanisms at the network layer, which will enable the ISPs to charge for the usage of their network resources. According to the analysis of the ISP business, specific examples on how current key players could use M3I are presented.

3 Presentation of Stakeholders in the Internet Marketplace

3.1 Role Model Basics

A role model is comprised of roles and relations. A role represents a group of functions, enabling any entity taking on the role to provide a set of services to its environment. It is essential to separate the role model from a stakeholder or a marketplace. Therefore, a stakeholder is defined as an entity that is taking on one or several roles. Other stakeholders in the marketplace can take on a subset or the same set of roles (i.e. competitors are present in the same market place). There is no single unique mapping between the role model and a stakeholder. The marketplace is the environment where the business activities and the total value created by a stakeholder are observed.

From the business perspective, it will be natural to think of roles as objects that can be defined by templates and instantiated in the description of specific business models. So, even if it is not considered necessary to make the role model definition overly formal, the general notion of a role is depicted.

A role "instance" will interact co-operatively with other role "instances" in the process of service provisioning. It is assumed that the functions of a role can be grouped into:

- **Service functions** that describe the role instance actions, which generally include consumption of services from its environment and combination of the consumed services with its own service function in order to again offer other services to the environment. To perform this operation, the role instance will use resources at its disposal (owned or rent);
- **Charging functions** that enable the monitoring of resource usage and service deployment. A charging function can interact with similar functions in the environment. Such interactions would typically be reports on resource usage in some agreed format. If enough of the internal resource usage of a third party is visible within the service function associated with a given charging function, performing charging for such third parties can be offered as a service in itself;
- **Business policy functions** that include the decisions taken on (1) services, tariffs and possible service level agreements associated with services to be offered to the environment, and (2) how to deploy services offered to the role instance based on their prices, service characteristics and possible associated service level agreements. The business policy function takes internal input from the service and charging functions. External exchanges may include tariffs, service definitions and service agreements; generally the information needed on whom should pay whom what for what service.

3.2 Description of Stakeholders and Structure of the Internet Marketplace

A stakeholder in the Internet is defined as an economic entity that could take on one or more roles and run them as business activities. The type of a stakeholder on the Internet can be classified according to different criteria. At the highest level of abstraction, classification is based on 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 include money transfer. Accordingly, two types of stakeholders can be identified:

- ***Consumer***: the stakeholder (also named ***Customer***) that uses a set of services provided by one or more service providers. A consumer might be a person or a business;
- ***Service Provider***: the stakeholder that provides 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 place, 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 be in different positions when considering different business relationships. In order to distinguish those stakeholders in more detail, the stakeholders are classified according to the type of service they provide or consume.

Instead of provisioning the service themselves, stakeholders may just buy the service and resell it. Three different activities are identified, according to the value that is added in a basic service: reseller, value-added service provider, and risk broker.

1. The **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.
2. The **Value-Added Service Provider** adds value to a service by modifying or customising a service for a customer group or an individual customer. The VASP might have purchased the basic service. There are various service types, i.e. connectivity service or information service. An example of such a service provider is a communication provider who adds portability support, tailored address directories, or authorisation restriction to a basic e-mail service.
3. The **Risk Broker** provides risk hedging to customers, who want to limit uncertainty about price changes, service quality, in the Internet marketplace. The Risk broker charges for this kind of service a higher fee than the actual cost might be if no complications occur. The risk broker acts like an insurance company. The risk broker might be a connectivity provider or an information provider.

In order to facilitate the marketplace analysis, two layers that reflect the main types of services are introduced: the ***Infrastructure Layer*** and the ***Internet Service Layer*** (Figure 1).

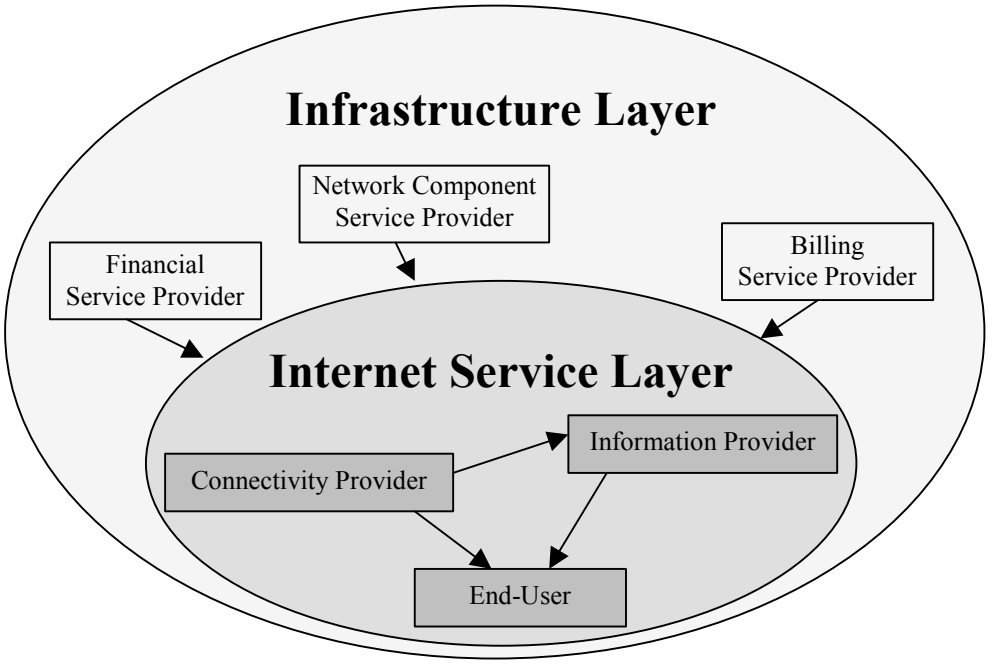

Figure 1: *Layers and Stakeholders in the Internet Marketplace*

Project "M3I" targets the stakeholders in the Internet service layer. In order to be able to describe the business relationship between information providers, connectivity providers, and end-user, a more detail classification and description of business entities within each of these groups is necessary.

The **Infrastructure Layer** consists of the stakeholders that provide complementary service to the Internet layer participants, but are not directly involved in the business transaction between the stakeholders 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**: this stakeholder owns network lines or computers, which it leases to others. He is not involved in any kind of data transmission;
- **Financial Service Provider**: this stakeholder provides services for completing money transfers. An example for such a stakeholder is a credit card company;
- **Billing Service Provider**: this stakeholder provides services to those who outsource customers' billing.

The stakeholders of the **Internet Service Layer** are characterised 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). However, such service may be bundled with an input from the infrastructure layer (i.e. physical network). According to the definition of this layer, several types of business entities are identified and grouped into the three generic classes:

- **Connectivity Provider**: this type of stakeholders provides the means to forward IP data packets on its network. A connectivity provider can be an access provider, a backbone provider, a data centre provider, and an end-user network provider;

- **Information Provider**: this type of stakeholders provides services on top of the network services provided by the connectivity provider. An information 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**: this type of stakeholders do not resell the service, they only consume it.

Stakeholders, who belong to the connectivity provider or information provider, are also called by a common name - **Internet Service Providers.**

3.3 Internet Stakeholders' Business Activities

Having identified the key stakeholders in the Internet layer, further classification according to specific business activities is presented. This leads to a more detailed distinction between stakeholders and facilitates analysis of business relationships.

3.3.1 Connectivity Provider

The connectivity provider can be classified according to the functionality of the IP network within the Internet. Therefore, four types of connectivity provider are identified:

- ***End-User Network Provider***: this stakeholder can be the end-user itself or a corporation. The end-user is responsible for managing the network (e.g. a single PC or a LAN) or using the network of a corporation she belongs to;
- ***Access Provider***: this stakeholder covers the "last mile" between the end user and the backbone provider, utilising copper lines, fibre lines, or radio technologies. The dial-in modem provider (e.g. AOL) and the local telephone companies (e.g. Pacific Bell or SBC), which provide the telephone line for connecting to the Internet, are access providers. Other examples of access providers are mobile service providers (e.g. Vodafone) or wireless service providers (e.g. @speed);
- ***Backbone Provider***: this stakeholder 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 Centre Provider***: this stakeholder provides 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.

3.3.2 Information Provider

Information providers can be classified according to the type of application services they deliver. Five different types of this stakeholder are identified:

Application Service Provider: this stakeholder provides the lease of usage time of software applications he owns. The application software provider takes care of maintenance and management of the software. Examples of such applications are www-server (web hosting), SAP, and FileMaker;

Content Provider: this stakeholder collects, organises, and presents information. Examples of content providers are, Marketwatch and CNN, which specialise on certain topics. Other content providers speed up access to information (e.g. Yahoo);

Internet Retailer: this stakeholder sells products on the Internet. Examples for product retailers are Amazon.com and Barnesandnoble.com;

Communication Service Provider: this stakeholder offers services like Internet telephony, e-mail, or fax. Companies like Net2Phone, AOL, and efax.com are examples of this type of stakeholder;

Market Place Provider: this stakeholder either brokers information of other service providers or provides an environment for providers to offer their services. In both cases, consumers can easily evaluate services. Examples of this kind of service provider are brokers and electronic market places like BandX.

3.3.3 End User

The end user is the stakeholder who consumes an Internet service. Thus, the end user is a customer of the ISP. The basic classification among customers' types is business and residential ones. Business customers include every business entity that uses Internet services for generating revenue inside or outside the Internet. A residential customer is an individual who consumes Internet services for increasing his utility. Residential customers have lower propensity to spent money for Internet services than business ones. This difference is critical when considering the ISP pricing strategy and consequently has an effect on its total revenue.

As far as business customers are concerned a further distinction can be made, according to their size, in small and medium businesses and large ones. Size is defined according to economic viability (i.e. profits, turnover, assets) and to activities´ scope of the company.

4 Description of Internet Stakeholders' Business Relationships and Value Flows

The business relationships model describes the relationships between the Internet stakeholders. The basic business relationships between the connectivity provider, the information provider, and the end-user are presented in (Figure 2), where arrows represent the direction of the service delivery: $ISP_x \rightarrow ISP_y$ means *ISP_x delivers service to ISP_y*. The connectivity provider might provide services to the information provider, the end-user, and to the connectivity provider. Information providers only offer services to end-user and other information provider. The end-user only consumes services.

The interaction among the connectivity providers is determined by their functionality in the Internet. The end-user's network is always connected to the access provider's network, whereas the access provider has at least one connection to the backbone. Data centres are located within the backbone (see black arrows within the connectivity provider box in Figure 2).

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

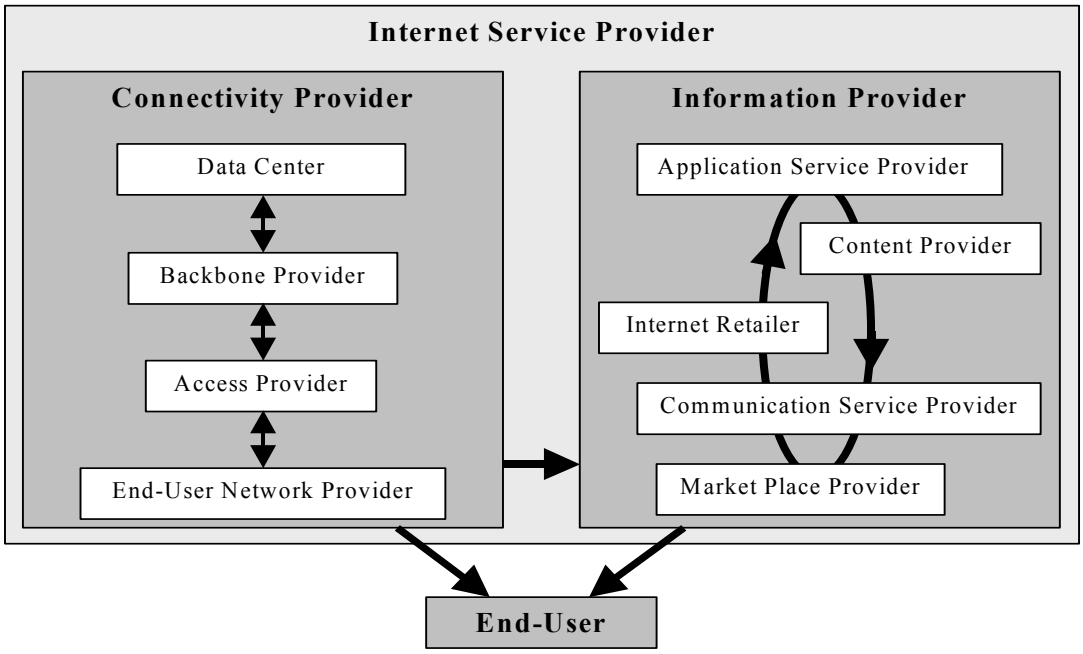

Figure 2: Generic Stakeholders and Business Relationships

In more detail, the business relationships between an ISP and other stakeholders comprise the exchange of usage charging information, service provisioning information, and traffic data (e.g. quality of service). For instance, the exchange of connection usage data might be necessary in order to collate accounting information with access providers. The exchange of modem pool blocking data is interesting in order to relate to overall QoS objectives. Metered IP traffic could be exchanged in order to decide on possible terms of interconnection agreements between backbone providers.

4.1 Example of Business Relationships between Internet Stakeholders

An example of possible relationships between an ISP and other stakeholders is shown in Figure 3. There are four stakeholders present. It is assumed that the generic ISP offers e-mail service (i.e. communication service) and network connectivity via telephone dial-up service to his customers (i.e. access service). 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 end-user connects to the generic ISP's modem pool by using her local telephone line. The local telephone company is the access provider in this scenario.

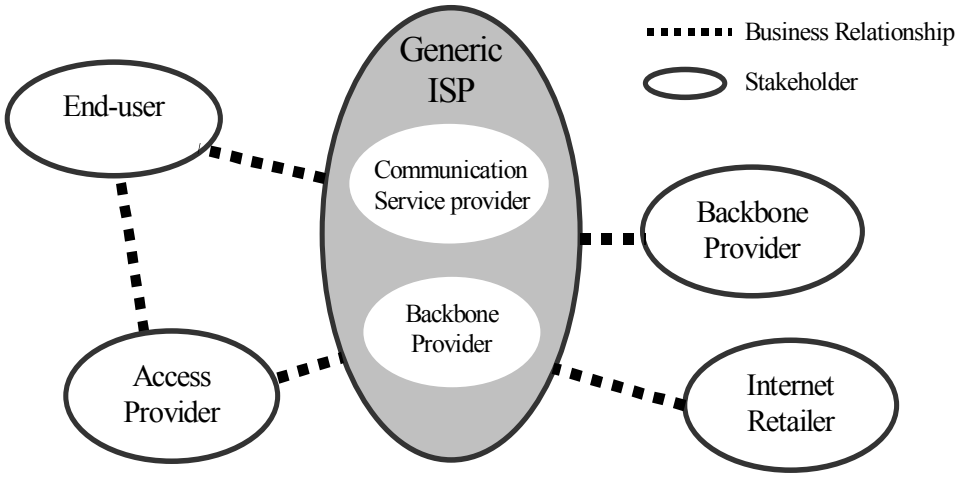

Figure 3: Example of the Business Relationships of a Generic ISP

The revenue stream of the generic ISP comes from the subscription fee of end-users subscribed to its services, the termination fee from the access provider (e.g. local telephone company), and the sales commission from 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.

4.2 Revenue Streams and Money Flows

Economic theory defines revenue as the price of a good or service times the quantity demanded. In order to analyse revenue streams in the Internet, it is important to determine the factors that affect Internet service's price and quantity demanded.

One of the main revenue sources in the Internet marketplace is the customer base. In order to analyse revenue streams generation in the Internet business models, there is a need to identify which stakeholder owns the customer base. In many cases, the stakeholder who owns the customer base decides on new business relations with other stakeholders, driven by demand characteristics, thus changing the business model.

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 on the market power of the ISP, (i.e. the size of the network, the number of end-users subscribed) and the type of service provided. However, in order to get a better understanding, some observations on current revenue streams are made:

- The backbone providers get revenue from termination agreements with access providers. Access providers charge customers according to the time being connected to the network, and this charge is split between the access provider and the backbone provider;
- Backbone providers' revenue streams depend on the size of their backbone network, the location of the network within the global network, and the type of agreements on traffic flow over interconnection points;
- The generic ISP gets revenue, apart from residential customers, from agreements with application providers, Internet retailer, and content providers connected directly to its network.

The above observations indicate that revenue flows are determined according to stakeholders' position in the value creation chain. In the Internet marketplace the customer demands a service, which is composed by infrastructure inputs (i.e. local and global access) applications, software inputs (i.e. operating system, browser) and content inputs (i.e. information). The value contribution of each input in such service varies according to the service characteristics (i.e. e-mail versus e-Commerce application).

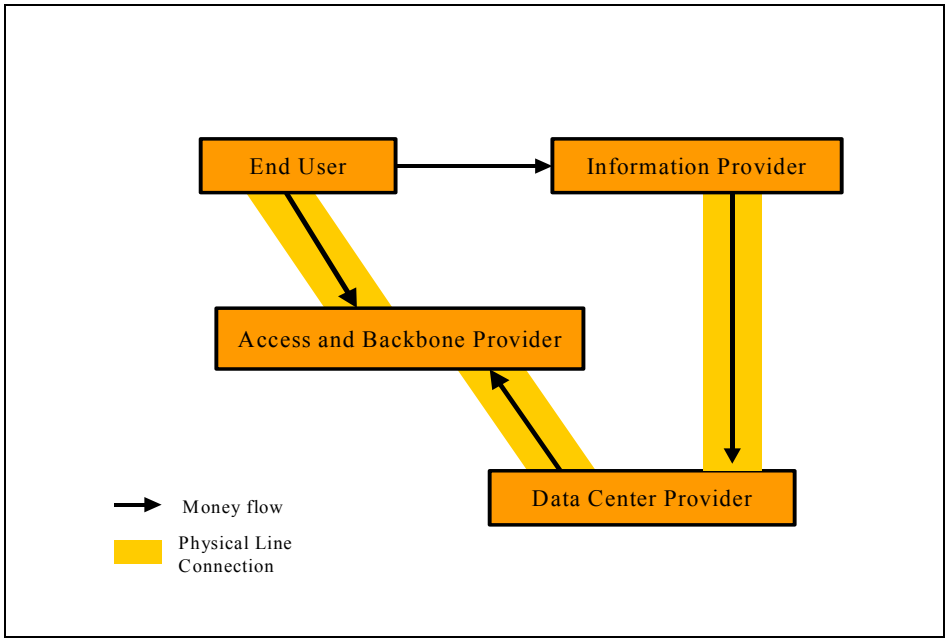

Figure 4: Example of Money Flows

The revenue distribution and money flows in the Internet marketplace depends on the contribution of each stakeholder in the service provision chain. Some stakeholders provide complementary inputs on the creation of a service. Such inputs may derive from a stakeholder of infrastructure layer, thus generating new money transfers. In these cases revenue distribution is even more difficult to be defined. Other stakeholders provide substitute inputs for the creation of a service. In these cases market characteristics such as degree of competition and strategic behaviour will affect money flows.

Figure 4 presents four stakeholders and the money flows that may appear between them in the business model of content provision to end-user. In addition the physical line connection that provides the necessary complementary infrastructure input for the delivery of a service is indicated. In this model several money flows are identified:

- End user to access/backbone provider: there is a money transfer-payment from the end user to the access/backbone provider for the network services (Internet access, connectivity and transport) that it delivers;
- Data Centre to Access/Backbone provider: there is a money transfer from the Data Centre to Access/ Backbone Provider for the network services and the network resources that it delivers and leases respectively;
- Information Provider to Data Centre: there is a money transfer from the Information provider to the Data Centre, for QoS services delivery (reliability of networks, security for the content etc.);
- End user to Information Provider: there is a money transfer from end user to information provider for content provision and delivery.

In this example the end user indirectly pays Data Centre through the money flow to Information Provider. This is due to the fact that Data Centre services are complementary input to Information Provider services. However, the end-service delivered to the customer is not perceived as a combination of various inputs. The end-user usually values the content as such. Thus, the Information Provider is pricing its service by including a portion of the cost of Data Centre services.

The market of multi-service provision provides the suitable environment for analysing pricing policies and revenue sharing mechanisms among key players and other stakeholders. It is not useful to analyse each service market alone as the various services provided in the Internet marketplace have very strong complementarities. However, the broad segmentation between network services and information services, is kept whenever relevant to the business relationships.

According to the current market trends best effort network services are becoming commodities. At the same time, the growing demand for premium services (application and content) increases the requirements for more than best effort network services and QoS provision. However, from the end user perspective the utility derived from application services is higher than the utility from network services. This means that end users may be reluctant to pay high amounts of money for network services, which are considered complementary goods to the content or application service provision. Yet, they expect to have such network services that will cover their application requirements. On the other hand network services with specific QoS parameters may be more expensive than information services.

A theoretical framework for pricing structure in a regulated multi-service company is provided by Laffont and Tirole [11] and answers the question of what is the optimal price structure for a multi-service company given that the overall price level must enable it to break even. Answering this question entails looking for prices of the various services that are preferred by the customers among the prices that yield a non-negative profit to the firm. In the case of independent goods, when demand is known, price structure may follow the Ramsey-Boiteux utility driven prices that are inversely proportional to the elasticities of demands for the services. However when services exhibit strong complementarities, standard marketing principles apply. Therefore it is optimal to lower the price of a service below the marginal cost, if doing so raises the price of a complementary service on which the company charges a mark-up.

Another interesting aspect that may affect revenue flows concerns the industry structure with respect to vertical or horizontal integration. In the case of the Internet marketplace, when focusing on network services trends towards vertical integration are observed. In the case of applications/content provision services, trends towards

horizontal integration are observed. ISPs that plan to widen their business scope and provide new value added or bundled services, are either merging or signing long-term collaboration agreements with content or application service providers.

4.3 Service Level Agreement (SLA)

The communication market experiences changes towards deregulation and liberalisation that lead to more complex configurations. The complexity is a consequence of the increasing users' demands for global services and the increasing number and type of parties/actors involved in service provisioning. In such a market, in order to satisfy users' demands for global services, service providers may have to rely upon other providers involved in service provision. For providers this offers profitable business opportunities but also risks. The main risk, when attempting to fulfil users' requests for end-to-end services, is that this process includes processes in other providers' domain that are outside main service provider's control. Therefore, there is a need for (standardised) interfaces and agreements, which can make the service provisioning as fast, accurate and automatic as possible.

Facing such situations, where changes are rather dynamic, the need for describing principles for arranging relationships between the actors is steadily getting more pronounced. Generally speaking, any relationship between two actors is associated with a set of expectations as well as a set of obligations. These expectations and obligations may be implicit, but it is always better to have them explicitly agreed, especially in business context. A *Service Level Agreement* (SLA) is an explicit statement of the expectations and obligations that are agreed between two actors: a customer and a provider. Different definitions of the SLA-term, or more general of an agreement, can be found in literature, e.g. in [21], [17], [13], [14].

SLAs can be defined and used in the context of any industry in which a provider-user relationship exists. Hence, SLAs have been widely used in different industries and businesses, for outsourcing services, e.g. help desks, catering services, IT competence centre, etc. For traditional telecommunication services (e.g. telephony) similar concepts covering similar aspects (e.g. QoS) have been applied, which did not have the form of an SLA. The presence and the concept of the SLA is rather unexplored for IP-based services, where many issues, both technological and business, have still to be studied. In addition, the situation is complicated by having shorter time to roll out a service, the functionality included in the technology used varies very much, the global picture of the market (both customers' demands and providers' roles) is changing.

Having a structure that is generic so it can be applied each time a change in the market is identified (e.g. new service introduction, new partner present etc.) would speed up the process of handling SLAs. Hence, after giving an SLA overview, the generic structure of a QoS-related part of an SLA is described in this document. Some examples of the existing formats and contents of SLAs for services like telephony, IP-based services are given next. These are result of work done in different research and standardisation fora, e.g. Internet Engineering Task Force (IETF), International Telecommunication Union (ITU-T), and Telemanagement Forum (ex Network Management Forum, NMF). The document concludes by the discussion of the future and relevance of SLAs.

4.3.1 SLA Overview

An agreement is "a harmonised understanding between two entities represented as a set of statements, which describes the result of a negotiation process" [17]. An SLA

can be understood as a type of agreement that describes the service and the performance level of the service required from the provider by a customer.

The agreement is designed in order to create a common understanding of the service, quality of that service, prices/pricing schemes, priorities, responsibilities, etc. Simply, it should specify what the user would get and what the provider is committing to provide. Various aspects of the relationships between the parties involved, like service/resource performance(s), help desk, billing, provisioning, service management, etc. can be included. An SLA would typically include:

- The type and nature of the service to be provided. All the components should be identified and described. The description of components related to particular interfaces is not a trivial task;
- The QoS of the service provided (this part will be elaborated further on in the following section);
- The process of reporting problems and troubleshooting process, which may include the information about the triggering events, the person to be contacted if the problem occurs, the format of the complaint, the step-by-step process for troubleshooting, etc. The time period for resolving the problems should also be defined;
- The process for monitoring and reporting the performance and quality delivered. Here, the issues of measurements, which type of statistics, how often, where the measurements should be undertaken, the data collection, analysis, access to the past statistics, etc. would be usually described;
- The consequences and the reaction pattern for the cases when either the user or the provider did not obey what was agreed in the SLA. Additionally, the constraints on the user behaviour may be included (e.g., the type of the equipment, PC for example, necessary to experience the quality as agreed). Escape clauses may be included to define when the statements from the agreement do not apply – e.g. a fire damaged the provider's equipment, etc.

In addition, legal, economic, regulatory, etc. issues are usually included. Some examples of the agreements for the telephony and IP transfer service are given afterwards.

Regarding the dynamics of changes in SLAs, generally speaking they can be either static or dynamic. Static SLAs are not modified or deleted but they support merging of new profiles in a timely manner. Dynamic SLAs allow existing profiles to be modified or deleted. The enforcement of both static and dynamic SLAs needs to be monitored and recorded for management purposes. Each SLA is contracted for a certain period – usually for outsourcing services outside telecom (e.g. catering, etc.) it is 3-10 years. In telecommunications, the dynamics of SLAs is more stretched, in the sense that an SLA may be static i.e. contracted on monthly, yearly base, but recently it is also very common to require an SLA contracted e.g. per session, transaction, 10 minutes, etc.

Also, the time scale of different processes like negotiation, instantiation of a service, etc. might influence the SLA. One may for example agree upon the SLA in the negotiation phase, and then use the service afterwards; one SLA might be related only to one service instance (e.g. per session), or it might be valid for a certain period.

In order to achieve the end-to-end QoS in the inter-domain environment, the important issue is to have a common understanding of the issues stated in the SLA made between two business entities. Naturally, the language used for describing statements

(e.g. QoS parameters), the granularity of technical details and legal, economic issues used when making the SLA with a user would differ depending on the type of the user the provider is contracting with. In case of a residential user, the language used will be less technical, and the selection of QoS parameters would usually describe issues easily observable for the user. On the other hand, for the enterprise customer (and again depending on it size), for whom might be assumed to have personnel with e.g. the technical, jurisdictional, expertise, the language used will be usually more technical/judicial with more details, and the granularity of the issues tackled will be much higher (e.g. more QoS parameters that are found relevant, more measurement points, etc.).

4.3.2 SLA Structure and Content

In order to handle both increasing volume[1] of SLAs and their maintenance, as mentioned before, having the generic structure would help a lot. The word *generic* implies here the independence of service type, network, technology involved in service provisioning, type and organisation of entities involved etc. On the other hand, being generic does not exclude consideration of specific situation at each interface. In other words, a set of default/mandatory statements should be available/listed, which can be generally applied in addition to a set of additional/optional/service/user profile specific statements.

The differences in content and format of information relevant to the user and different providers should be also noted. That is, in case of user-provider agreements the language describing QoS issues/parameters should be less technical and understandable to the actual user. On the other side, an agreement between two providers could be more complex and expressed in more technical terms.

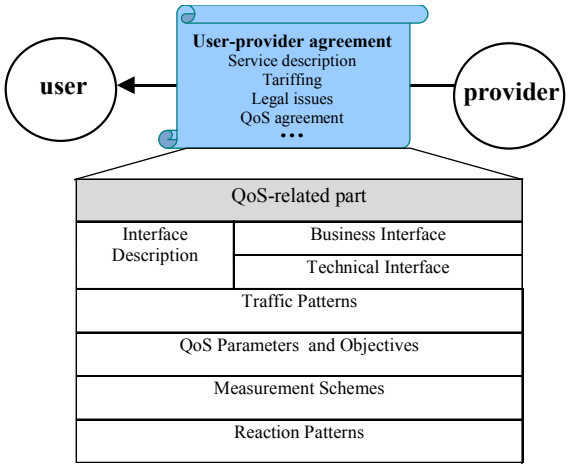

Figure 5: Generic Structure of the QoS-Related Part of an Agreement

Figure 5 depicts two actors having negotiating the service provision: a user and a provider. The service is delivered by the provider as indicated by the arrow, and the SLA between them includes some of the elements already mentioned - the description

[1] Nowadays, having SLAs is well-established custom on the business users' market. On the contrary, having SLAs for the Internet services offered by a provider to residential users is not an obligation and it may seem from the user's perspective that there is no need for the agreement at all. Thus, the volume of SLAs to be handled by the provider is not critical. There are foreseen significant changes and increase regarding to the presence of SLAs in the Internet market for residential users as well, similar to the situation in other industries.

of the service, legal, regulatory issues, economic issues – e.g. tariffing/price information, and the QoS-related part, on which focus is given on following.

The detailed description of QoS-related part of an agreement can be found in [17]. The brief overview is given here. Note that the description of several terms (like traffic flows) is commonly related to the operational phase and telecommunication traffic. However, this could be generalised in order to be applicable for every service life cycle phase. The corresponding terms should then be adapted in order to better describe the relevant aspects.

Interfaces Description includes the description of all the interaction points relevant for the agreement – both business and technical. It might contain the information on the service delivery point, protocol(s) to be used, measurement points, observation points, points where a reaction pattern will be applied, etc.

Traffic Pattern description describes the characteristics of the expected traffic flows. This information allows the provider to manage resources in its domain in order to deliver the agreed QoS. The description of the traffic should envelop both application and management information flows. The characteristics of both the ingress and egress traffic should be described. Traffic patterns can be described on different time scales (e.g. during the day, per service instance, etc.). The parameters used to describe the traffic could be e.g. mean and/or average value for a throughput.

The description of **QoS Parameters and Objectives** implies expressing the performance of a service by assigning values to a number of QoS parameters [19]. The QoS parameters can be derived by applying the adapted ITU-T 3x3 matrix [22]. Considering **QoS Objectives**, they can be specified by target values (e.g. total maximum delay), or by thresholds set to a QoS parameter e.g. an upper (or a lower) bound (e.g. an upper bound for unavailability). The QoS objectives may be expressed also as guarantees – provider's commitment to the user with strict traffic and reaction patterns, or as QoS indications, which are associated with loose traffic patterns and slow reaction pattern. Since QoS objectives are closely related to both measurements and reaction patterns, both measurement procedures and conformance rules should (e.g. statistically) fit the granularity set to the QoS objective.

The **Measurements** description should include the statements who, where, when, and how should perform measurement and conformance testing processes for the agreed parameters. The description may include the identification of relevant measurement points, the specification of the measurement environment, description of the technique(s) for obtaining the measured values, specification of the methodology to present and evaluate the results by parameters, and the method to be used for taking decisions on acceptance based on the level of compliance of the measurement results with the stated requirements and commitments.

A set of **Reaction Patterns**, related to failure to meet either traffic patterns or one or more of the agreed QoS objectives should be described in the QoS agreement. Such a description may include the reaction patterns both for cases of detecting the non-conformant traffic and detecting the QoS degradation. The reaction patterns for both entities should be stated including the inputs to initiate the reaction (e.g. results of measurements), related constraints (the duration, timeliness, type of actions), resources and tools required to carry out the reaction, and the description of the reaction itself. The reactions could be technical (policing the traffic flows, suspending or aborting the activity, sending alarms, warnings, etc.), economic (e.g. discounts, initiation

of using compensation schemes), legal and ethical (e.g. publishing the “antispam black lists”), etc.

4.3.3 SLA Examples

The structure described before can be identified in more or less similar form in the examples illustrated in this section. Note that the actual content, e.g. selection of parameters, values, statistics, may differ, but the structure is not diverging. The idea is to highlight that the structure could be generic and standardised, while the content may differ for a particular service, interface observed, provider involved, etc.

The examples are presented in accordance to both the service they relate to and the fora that published it. First one example of an ITU-T agreement for the telephony is shown, followed by some examples and the ongoing work from IETF. Finally, the example of so called end-to-end SLA, from TMF (ex. NMF) is described.

ITU-T E.800 SQA

One example of the agreement can be found in the ITU-T’s Recommendation E.801 [12], which describes so called Service Quality Agreement (SQA) and considers the following as content:

- Introduction, e.g. describing the purpose of the agreement;
- Scope, e.g. the services covered and at which interfaces are to be presented;
- Confidentiality, for instance stating the confidentiality concerning the content of the agreement and sharing information between the user and the provider;
- Legal status, like stating the commitment to fulfil the conditions;
- Traffic patterns, e.g. describing relevant characteristics of the traffic flows;
- The relevant QoS parameters and corresponding (range of) target values;
- Measurement schemes, like describing points of observation, events to register and ways of aggregating the data;
- Reaction patterns, e.g. describing ways to act in case any of the conditions are not fulfilled;
- Management review process, like presenting procedure for reviewing the agreement, and
- Signatories.

This template is traditionally used for agreeing on the provision of e.g. telephony service, between different Public Network operators (PNOs).

IETF and SLA

The presence and effect of SLAs in the IP world should be discussed having in mind both the existing best-effort service and the intserv [18]/diffserv [20] models suggested by IETF.

Today’s best effort service model asks for no special agreements in the operational phase. One argument is that available resources are shared indiscriminately between the group of all users: there is no service discrimination. Some explicit statements describing the volume of traffic to be exchanged e.g. between two peering ISPs can be found. In case intserv/diffserv models are implemented, the SLA becomes more pronounced, as a way of regulating the conditions for service provisioning between a

customer and a provider, e.g. between an enterprise using the services provided by an Internet Service Provider (ISP).

An example of a user-provider SLA in the IP world is a UUNet's end-user SLA [15], where some metrics that SLAs may specify are given, e.g.

- The percentage of time the service will be available
- The number of users that can be served simultaneously
- Specific performance benchmark to which actual performance will be periodically compared
- The schedule for notification in advance of network changes that may affect users
- Help desk response time for various classes of problems
- Dial-in access availability
- Usage statistics that will be provided.

Work, currently under development within IETF, allows for a description of SLA schemes in an abstract common language. SLA schemas are described by a set of attributes. The attributes may be either common to both intserv/diffserv or specific for each of them. The common attributes can include name, scope, type, address range, max rate. Specific attributes for diffserv are e.g. TOS field masks and patterns, and for intserv e.g. flow service type, MaxFlows, token bucket parameters, etc. On the other hand, SLA can be structured by using references. This allows defining generic service profiles like a premium, gold, standard service package, or generic customer class profile like economy, professional, etc.

Also, a rather extensive amount of work is going on in the research and standardization fora, regarding a technical portion of an SLA, or more precise QoS-related part (as described previously). One example is the IST project "Tequila", where the structure of a Service Level Specification (SLS) is presented as a template to be used for automated negotiation of the SLS for IP transport services [24]. The project initiated the discussions in the IETF. More detail on the structure and content, framework for agreeing, as well as examples of the SLS can be found in [25], [26], [27], [28].

TMF and SLA – an example of SP-SP agreement

In addition, as mentioned before, the content of the agreement may differ depending on the interface it relates to. In other words, an agreement between a user and a service provider (SP) would differ from the agreement between two service providers. When considering the SP-SP agreement, Telecom Management Forum (ex NMF) defined business model and related processes, which could be used to define the potential content of the different SLA types.

The work done in NMF considers so called end-to-end SLA[2], which should contain agreements about the following issues/topics:

- the service type and customised service template,
- definition of common business processes (e.g. in the context of NMF Business Process model)
- common QoS needs,
- technical constraints
- definition of relevant QoS/performance parameters for the end-to-end relationship,
- notifications and actions in case of problems
- references to management interface types being supported (e.g. X.user, Xcoop)
- common management policies
- common security requirements, methods, policies
- common trouble administration interfaces, policies
- common accounting interfaces
- common interoperability tests an test suites, if interworking between all SPs is necessary

4.3.4 SLA – Pro and Contra

While numerous projects are trying to solve the future IP services support by introducing the concept of SLAs, the practice is rather unclear. Today, no SLA involves "hard" QoS guarantees for IP-based services, since technology development cannot support it to a fully extent. Examples of the content of current agreements can be found in [15], [16]. However, there are still many open issues to be looked upon. Undoubtedly, SLAs have a future, since in highly competitive multi-provision without co-operation "controlled" by agreements no service can be supported with assured guarantees.

[2] As mentioned before, there are numerous definitions of the agreement, SLA, etc. The one from NMF on the "end-to-end SLA" is "an SLA between multiple SPs, which defines common agreements between all parties involved in the service provisioning/consuming process" [23].

5 Paradigms of Internet Market Key Players and their Business Models

5.1 Paradigms of Key Players' Business Models

The dynamic nature of the Internet market, which presents high growth rates, and provides new business opportunities, is creating a unique environment for business modelling research. However it is a great challenge to define and analyse the business models of this market. In order to provide a thorough analysis of the current market and identify new business opportunities for the key players, the Internet Service Providers, the supply side segmentation of the market is used, and relevant data from demand side are introduced whenever needed.

Internet marketplaces can be classified according to supply or demand perspective. From the supply perspective classification is based on the type of services provided. There are two broad categories of services: network services and application services. From the demand side there are two types of customers: residential customers and corporate ones. In addition, corporate customers are segmented to small and medium enterprises (SMEs) and large corporations, according to the size of the company (i.e. total assets, total revenues, number of employees).

In particular, five business models in the Internet market are analysed. Those are AOL, Mindspring/Earthlink, Covad, Exodus and Akamai. These business models cover the overall scope of an ISP. All of the cases include network and information services provision, in different a mixture of services. When analysing the business models both types of services, which are usually provided bundled to customers, are considered.

During the process of identifying the stakeholders involved other players that participate in the business model indirectly appeared. These are companies that advertise their content on the ISP subscribers. They usually pay an amount of money to the ISP, according to various criteria (availability of space, advertisement time), thus contribute to the total ISP revenue. However such companies are out of scope of M3I. In particular, they do not represent target market of the ISPs under consideration. Their participation in the business model has secondary effects. Such players are exploiting network externalities, and do not create any value added to the services under consideration and consequently the business model as such. When analysing money flows in the business model emphasis is given on the relations that may be improved through the introduction of M3I. Thus, the contribution of such stakeholders is important only when considering the total revenue of an ISP.

5.2 Business Objectives of Key Players

Having identified examples of key player types in the current Internet market, (Table 1) the services they provide and deliver to their customers along with those resold are presented.

Service	AOL	Mindspring/ Earthlink	Covad	Exodus	Akamai
Access	X*	X	X	X	---
Backbone	X*	X*	X	X	---
Data Centre	---	X*	---	X	X
Application	---	---	---	---	X
Content	X	---	---	---	---
Retailer	X	X	---	---	---
Communication	X	X	---	---	---

*reselling

Table 1: Key Players' Services Provision

Considering these examples of ISP business, it becomes obvious that the ISPs are focusing on certain needs of end-users (customer base). For example, Covad sells high-speed access to the Internet. In order to achieve that, Covad teams up with ISPs like AOL and Mindspring, which resell Covad's DSL service. Exodus and Akamai are addressing the need of information providers to deliver their information reliably and fast. Both companies are trying to increase the performance of the Internet by providing solutions, which improve the quality of service. Akamai offers specialized services for fast content and streaming media delivery. Exodus offers a highly secured and reliable backbone and data centre service. AOL and Mindspring customer base consist of residential end-users. Both companies' basic service is access. In addition, AOL delivers content to its customers, which is either directly or indirectly created by third party companies. Mindspring offers web site hosting services.

	AOL	Mindspring/ Earthlink	Covad	Exodus	Akamai
Customer	Residential Customers	Residential and Business Customers	Business Customers	Business Customers	Business Customers
Addressed Needs of Customers	Backbone Connectivity and Content	Broadband and Narrowband and Hosting	Broadband Access and VPN	Reliable Information Delivery	Fast Content and Streaming Media Delivery
Owned Services	Content	Hosting	Access and Backbone	Backbone and Data Centres	Data Centres
Bundled in Services	Access and Backbone	Access, Data Centre, and Backbone	---	Broadband Access	---

Table 2: Business Objectives of Key Players

The key players´ business objectives are provided in Table 2. This table also presents the business scope and the services delivered to the customers. Services are either

produced by the company or bought from third parties and resold. Services are provided either separate or bundled.

These facts show that each company targets specific market segments. AOL's business strategy is to become a media player offering all kind of services from shopping to entertainment. Because of the merger with Time Warner, AOL is able to offer all kind of content for their customer. Mindspring attracts customers by offering web site hosting service. For both of them, it is important to differentiate themselves from their competitors, since competition is expected to increase in the future. Covad is solely in the broadband access market. Exodus is focusing on the data centre market. Akamai provides a solution for companies, which require better-than-best-effort network services. As long as the Internet is not able to deliver QoS at acceptable costs, Akamai's business model will be successful.

5.2.1 America On-Line

AOL is considered as an information provider according to its core business activities. AOL has a leading position in interactive services and applications provision market. In 2000, AOL operates two worldwide subscription based Internet online services, America Online, with more than 18 million members, and CompuServe, with approximately 2 million members. Through its strategic alliance with Sun Microsystems, it also develops and offers easy-to-deploy, end-to-end e-commerce applications. Its customer base includes the paying subscribers of the AOL and CompuServe services, as well as users of the Company's other branded portals and services such as AOL MovieFone, Netcenter (with more than 17 million registered users), AOL.COM, ICQ and Digital City. AOL revenue mix consists of (based on Income Statement of the first quarter of 2000):

- Subscription services 64%
- Advertising and content provision services 29%
- Application provision services 7%

AOL currently has two major lines of businesses, the *Interactive Service Online business* and the *Netscape Enterprise Solution business* organized into four product groups. These groups are supported by a common infrastructure. This organization structure allows the Company to develop and grow multiple revenue streams by utilizing the common infrastructure across the multiple brands it currently has, as well as cost-effectively compete in new and emerging markets.

The **Interactive Services Group** operates the interactive products: the AOL and CompuServe services and their related brand and product extensions, including AOL Instant Messenger and AOL.COM, Netscape Netcenter and the Netscape Communicator client software, including the Netscape Navigator browser. This group is also charged with rapidly delivering high-quality, world-class products, features and functionality across all branded services and properties and also has responsibility for broadband development and AOL devices like AOL TV.

The **Interactive Properties Group** operates ICQ, Digital City, MovieFone, Direct Marketing Services ("DMS"), Spinner Networks Incorporated and Nullsoft, Inc., developer of the Winamp and SHOUTcast brands. This group is responsible for building new revenue streams by seeking out opportunities to build or acquire branded properties that operate across multiple services or platforms

The **AOL International Group** oversees the AOL and CompuServe services outside of the U.S., as well as the Netscape Online service. The AOL International Group operates the AOL and CompuServe brands in Europe with its joint venture partner Bertelsmann AG, AOL Canada, AOL Japan, with its joint venture partners Mitsui and Nikkei, and AOL in Australia with Bertelsmann. AOL plans to launch services in Hong Kong with China Internet Corporation and in Latin America with the Cisneros Group.

The **Netscape Enterprise Group** serves Netscape's enterprise customers and contributes to America Online's part of the strategic alliance with Sun. In combination with dedicated resources from Sun, the Netscape Enterprise Group delivers easy-to-deploy, end-to-end solutions to help business partners and other companies put their businesses online.

Advertising and commerce revenues are generated mainly from businesses marketing to AOL's customer base across its multiple brands. An important component of AOL's business strategy in its Interactive Online services business is an increasing reliance on advertising, commerce and other revenues. These revenues include advertising and e-commerce fees, the sale of merchandise, as well as other revenues, which consist primarily of royalty fees and development revenues, as well as data network service revenues generated by ANS Communications.

Business application provision revenues consist principally of product licensing fees and fees from technical support, consulting and training services. The Netscape Enterprise Solutions business generates revenues that consist principally of product licensing fees and fees from technical support, consulting and training services. The Netscape Enterprise Group focuses on providing businesses a range of software products, technical support, consulting and training services. These products and services enable businesses and users to share information, manage networks and facilitate e-commerce deployment. In November 1998, the company entered into a strategic alliance with Sun Microsystems, to accelerate the growth of e-commerce. The strategic alliance provides that, over a three year period, the company will develop and market, together with Sun, client software and network application and server software for e-commerce, extended communities and connectivity, including software based in part on the Netscape code base, on Sun code and technology and on certain America Online services features, to businesses.

AOL competes with a wide range of other companies in the communications, advertising, entertainment, information, media, web-based services, software, technology, direct mail and e-commerce fields for subscription, advertising, and commerce revenues, and in the development of distribution technologies and equipment in its Interactive Online Services business. AOL also competes with a wide range of companies in the development and sale of e-commerce infrastructure and applications in its Enterprise Solutions business.

AOL marketing strategy is expected to continue to emphasize brand advertising across multiple brands as well as cost-effective bundling agreements, where the company's products are widely distributed with new personal computers, the Windows operating system and other peripheral computer equipment and software. Additionally, the company will continue to market its products via direct mail programs.

Based on the description of AOL business profile, its business relationships model with other stakeholders in the Internet marketplace is presented (Figure 6).

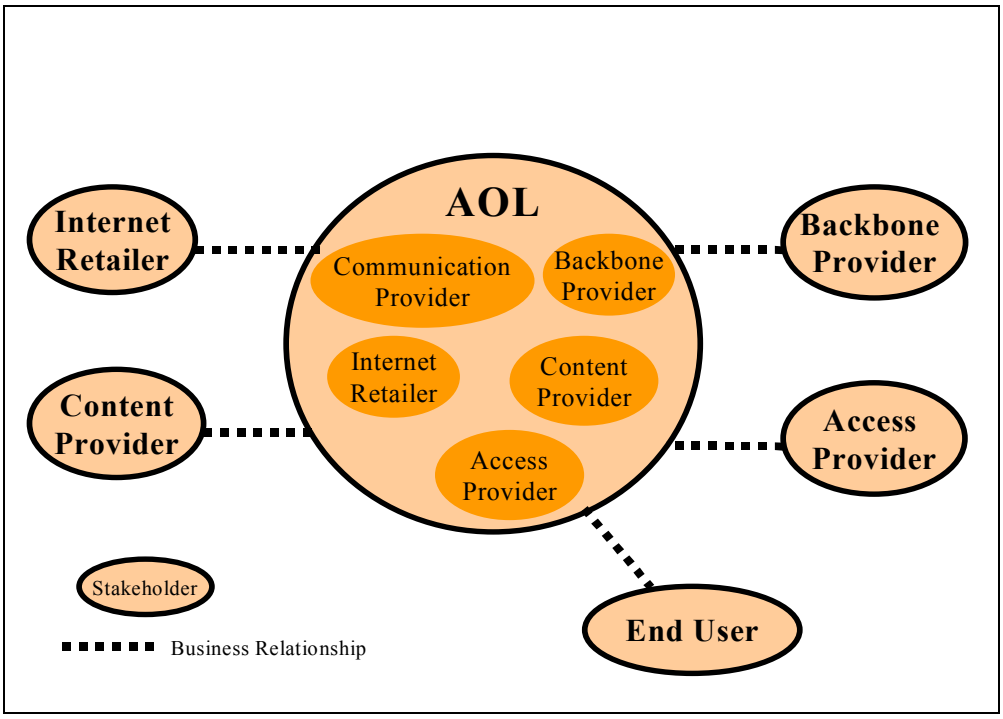

Figure 6: AOL Business Relationships Model

According to the stakeholders' typology identified in Section 3.3, AOL is an information provider that incorporates business activities of backbone provider, access provider, Internet retailer communication provider and content provider. AOL provides network services, Internet access and connectivity, to residential end users. These services are bought from third parties and then resold in bundles. AOL also provides information services, content and applications, which are either produced or bought from third parties.

AOL business relationships model (Figure 6) presents four stakeholders: a backbone provider, an Internet retailer, a content provider and the end user. According to the service delivery process the value flows between the stakeholders involved with AOL are identified:

- *BackboneProvider-AOL*: this business relationship concerns the provision of network services. AOL does not own its own network infrastructure, but rather uses network infrastructure of backbone providers, Sprint, GTE, and MCI Worldcom Advanced Networks.
- *Content Provider-AOL:* this business relationship concerns provision of content and marketing services. AOL incorporates the role of content provider through Interactive Service Online business. Content provision is one of the main revenue streams of AOL. AOL is exploiting its large customer base by directly providing its own content or reselling other stakeholders content. Therefore it also generates revenue from advertisement fees. Advertising revenues are expected to grow in importance as the company continues to leverage its large, active and growing customer base.
- *Internet Retailer-AOL:* this business relationship concerns AOL's intermediation between a retailer and an end customer, as a sales point for products and services. The retailer usually pays AOL a commission on the total sales revenue. The recent strategic alliance of AOL and Sun Microsystems provides revenue to AOL through selling e-commerce applications to business segment. In addition AOL incorporates

the role of Internet retailer through Netscape Entreprise Solution business, which is coordinating and running e-commerce activities in retail sector.

- *End User-AOL*: this business relationship concerns AOL's provision of bundled (access and content) services to the end user. The revenue mix consists of: subscription services 64%, advertising and content provision services 29% and application provision services 7%. Subscription services revenues are generated from customers subscribing to the company's AOL service and the CompuServe service. Currently, the company's Interactive Online Services business generates subscription services revenue primarily from subscribers paying a monthly membership fee. The company's current pricing scheme consists of:
  - A standard monthly membership fee of $21.95, with no additional hourly charges (the "Flat-Rate Plan").
  - An alternative offering of three hours for $4.95 per month, with additional time priced at $2.50 per hour.
  - An alternative offering of $9.95 per month for unlimited use-for those subscribers who have an Internet connection other than through AOL and use this connection to access AOL services.

5.2.2 Mindspring / Earthlink

Mindspring/Earthlink is considered as a connectivity provider according to its core business activities. The revenue mix consists of (based on Income Statement of the first quarter of 2000):

- Narrowband provision services 88,4%
- Broadband provision services 2,6%
- Web hosting services 7%
- Content provision services 2%

EarthLink was one of the world's leading ISPs, with more than 3.7 million individuals and businesses customers. EarthLink provided a full range of innovative access, hosting, and e-commerce applications internationally from more than 5,000 points of presence.

MindSpring Enterprises, offered local Internet access in more than 780 locations throughout the U.S. The MindSpring Biz division of MindSpring Enterprises was a leading provider of Web Hosting services and domain registrations.

As announced in February 2000, EarthLink completed its merger with MindSpring. The combined company is the nation's leading independent ISP and brings together joint experience in customer service. MindSpring and EarthLink were ranked first and second in customer satisfaction among the largest ISPs according 1999 National ISP Online Residential Customer Satisfaction Study. The merger between EarthLink and MindSpring solidifies the new company's position in four key areas of growth from which the company will continue to diversify its revenue base. These business-focused areas include: narrowband, broadband, Web hosting, and content, commerce and advertising revenue.

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

Mindspring/Earthlink broadband services now cover 55 major metropolitan areas. With 25,000 broadband customers, Mindspring/Earthlink is aggressively upgrading its narrowband members to high-speed access solutions. The rollout of high-speed access to twelve new major cities allowed Mindspring/Earthlink to rapidly expand its geographical offering of broadband access in 15 markets. In addition to its commitment for delivering broadband access, Mindspring/Earthlink also secured broadband partnerships with ABCNEWS.com, ESPN.com, FOXNews.com, FOXSports.com and ZDNet to deliver quality broadband content to its customers. Mindspring/Earthlink is a leading provider in the broadband market and has eight broadband partners: Bell South, Charter Communications, Covad, GTEi, Knology, PacBell, Sprint and UUNet. These facts demonstrate the potential to successfully penetrate the broadband market and capture an increasing share of the market.

Narrowband revenues for the second quarter of 2000 were $196.3 million. The continuing growth of their narrowband customer base and revenues validates the success in serving the core member base. Their commitment to providing reliable, premium quality customer service and support is expected to spur further growth in this sector while allowing them to upgrade existing customers to higher-end services such as broadband and web hosting. The company continues to place a high emphasis on the switcher market and user experience to attract new members and retain existing ones. During 1999, the company released EarthLink 5.0, the next generation of software targeted to users who are both new and skilled in using the Internet.

Additionally during 1999, MindSpring announced an agreement with RAVISENT Technologies to deliver a unique Internet appliance that allows members to access the Internet and surf the Web without a computer. Finally, to expand its reach and attract new users getting online, EarthLink announced a deal with Apple Computer shortly after the quarter ended, becoming the exclusive ISP for all Apple setup programs in the U.S.

With respect to content, commerce, and advertising revenues Mindspring/Earthlink had a total of 71 Partners in its Premier Partner program, as well as 107 merchants serving its popular e-commerce site, “The Mall”.

In March 2000, Mindspring/Earthlink hosted 135,000 Web sites through its Web hosting division. Based on number of paying customers, Mindspring/Earthlink continues to be one of the largest providers of web hosting services. In March 2000, Mindspring/Earthlink announced an agreement to acquire OneMain.com, one of the country's ten largest ISPs. This acquisition will expand its customer base to include over 762,000 members and national market coverage to include rural communities and smaller cities. Mindspring/Earthlink remains committed to empowering small businesses to tap into the numerous opportunities on the Internet through its EarthLink Biz business services division. In a continued effort to service small- and medium-sized businesses, MindSpring launched its online business resources portal, mindspringbiz.com during the fourth quarter of 1999. The Web site is a portal dedicated to providing businesses with the tools they need for success on the Web such as small business solutions, industry information, guides, news, and discussion forums.

Mindspring/Earthlink recently announced that it entered into a national distribution agreement with leading computer manufacturer Hewlett-Packard, allowing consumers to select its award-winning Internet service straight from the desktop of the HP Pavilion home PC line. Mindspring/Earthlink will have a premier position across all HP Pavilion home PC sales channels.

According to the stakeholders' typology identified in Section 3.3, Mindspring/Earthlink is a connectivity provider that incorporates business activities of backbone provider, access provider, and data centre. Mindspring/Earthlink provides network services, Internet access and connectivity, to residential end users. These services are bought from third parties and then resold in bundle goods. Mindspring/Earthlink also provides web-hosting services to business end users, through its web hosting premises.

Based on the description of Mindspring/Earthlink business profile, the business relationships model with other stakeholders in the Internet marketplace is presented (Figure 7).

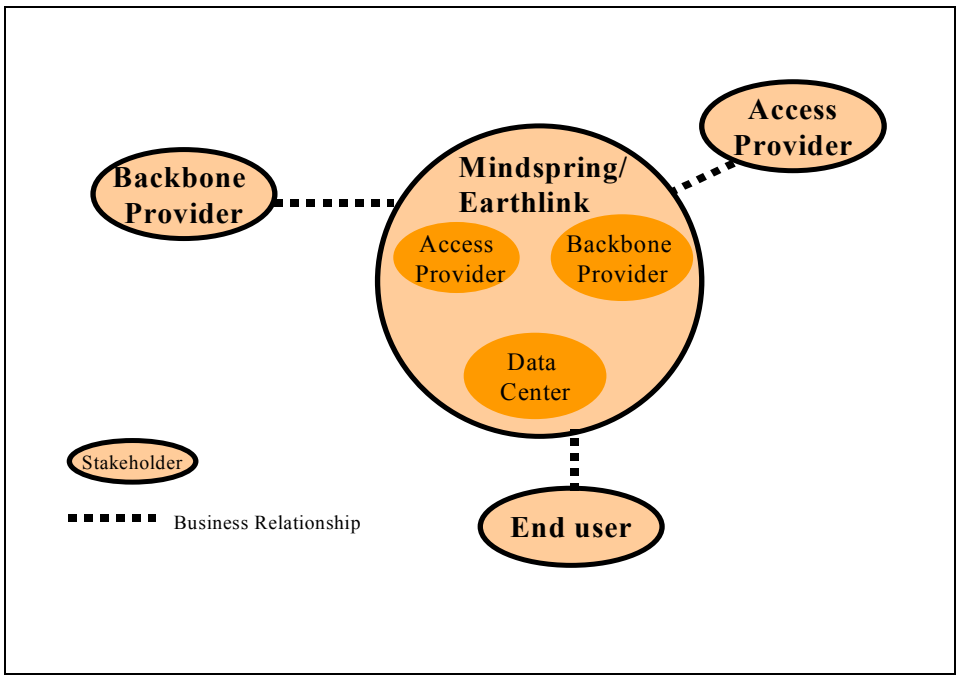

Figure 7: Mindspring/Earthlink Business Relationships Model

The Mindspring/Earthlink Business Relationships Model (Figure 7) presents three stakeholders; a backbone provider, an access provider and an end user. According to the service delivery process the value flows between the stakeholders involved with Mindspring/Earthlink are identified:

- *Backbone Provider-Mindspring/Earthlink*: this business relationship concerns leasing of backbone network from Sprint and PSInet. Mindspring/Earthlink does not own network infrastructure.
- *Access Provider-Mindspring/Earthlink*: this business relationship concerns leasing access network from whom to whom. Mindspring/Earthlink does not own physical network infrastructure except from the dial-up access sites in southern California.
- *End User-Mindspring/Earthlink*: this business relationship concerns services provision to both residential and business customers, especially SMEs.

5.2.3 Covad

Covad is considered as a connectivity provider, according to its core business activities that concern backbone services provision. Covad is a leading provider of broadband communications services to ISPs, businesses and telecommunications carrier, which however are only offered in metropolitan areas of the US. Covad has its own network,

which includes an US-wide backbone and the hardware equipment collocated at the ILEC central offices. In March 2000, Covad networks passed 35 million homes and businesses, and Covad had installed 93,000 end-user lines.

In March 2000, Covad offered 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. However, Covad does not sell its products directly to end-users. The customers are ISPs like Mindspring/Earthlink. In addition to this, Covad owns the subsidiary LaserLink.net that offers services to set up a virtual ISP. Covad manages and administrates the network while the customer sells the service as its own (wholesale business).

Covad recorded revenues of $41.8 million for the three months ended March 2000 compared to $5.6 million for the three months ended March 1999. This increase is attributable to growth in the number of customers and end-users resulting from increased sales and marketing efforts and the expansion of its national network. There are no available quantitative data on Covad revenue mix. Covad derive revenue from:

- Connectivity services provided to ISPs and business customers and charged by monthly rates
- Service provision in setting up the equipment to its customers
- Sales of customer premise equipment

The development and expansion of Covad's business requires significant expenditures. The principal capital expenditures incurred during the build up phase of any metropolitan area involve the procurement, design and construction of Covad central office cages, end-user DSL line cards, and expenditures for other elements of Covad's network design. Currently, the average cost to deploy Covad facilities in a central office, excluding end-user line cards, is approximately $85,000 per central office facility. Following the build out of Covad's central office space, the major portion of Covad's capital expenditures is the purchase of line cards to support incremental end-users.

In March 2000, the Company completed the acquisition of LaserLink.net, a leading provider of branded Internet access. Covad anticipates that this acquisition will allow provision of a turnkey broadband access solution to companies and affinity groups who want to offer broadband internet services to their customers, members, or affiliates. LaserLink.net currently provides a similar service using dial-up access.

According to the stakeholders' typology identified in Section 3.3, Covad is a connectivity provider that incorporates business activities of backbone provider and access provider. Covad provides network services, Internet access and connectivity, to ISPs and business end users, through its own infrastructure. Covad also provides VPN and customer support services.

Based on the description of Covad business profile, the business relationships model with other stakeholders in the Internet marketplace is presented (Figure 8).

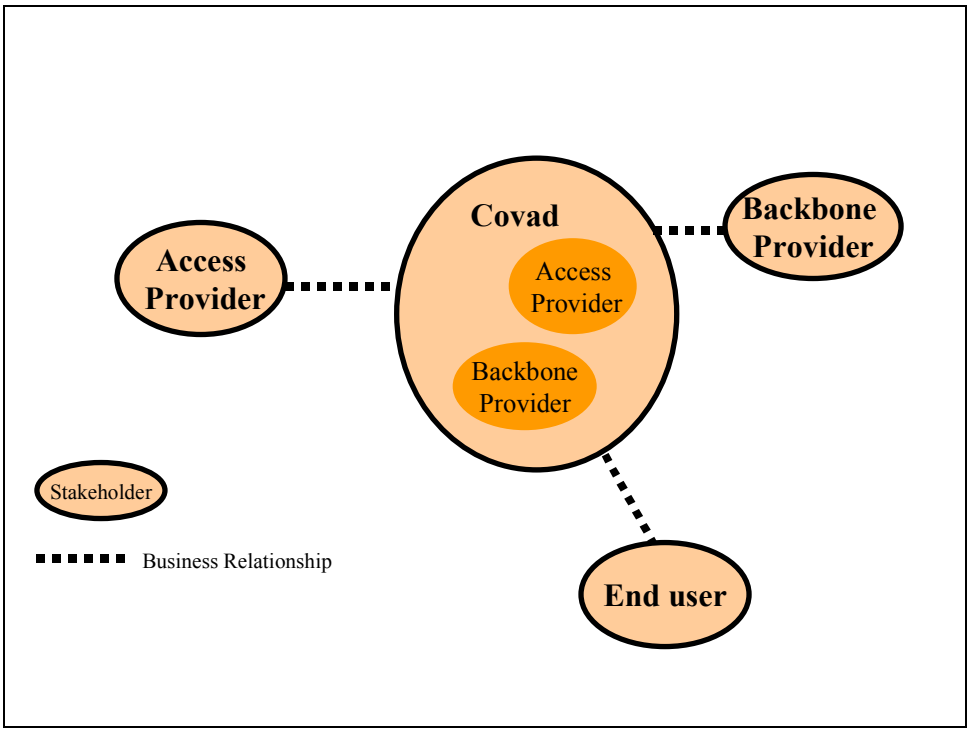

Figure 8: Covad Business Relationships Model

The Covad Business Relationships Model (Figure 8) presents three stakeholders; a backbone provider, an access provider and an end user. According to the service delivery process the value flows between the stakeholders involved with Covad are identified:

- *Backbone Provider-Covad*: this business relationship concerns the provision of network services. As both incorporate the backbone provider role, the exchange of services between them includes interconnectivity and transport services, probably based on peering agreements. Covad has its own expanding network in several metropolitan areas of the U.S;
- *Access Provider-Covad:* Covad pay traditional telephone companies and other competitive telecommunications companies non-recurring and recurring fees for services including installation, activation, monthly line costs, maintenance and repair of circuits between and among Covad's digital subscriber line access multiplexers and Covad regional data centres, customer backhaul, and end-user lines;
- *End User-Covad*: the main source of revenue for Covad derives from wholesale network services provision to regional ISPs. Covad also delivers VPN services to business customers.

5.2.4 Exodus

Exodus is considered as a connectivity provider, according to its core business activities. The company focuses on the Internet data centre market and owns a worldwide backbone. The data centres are located in Asia, Australia, North America, and Europe (Sweden, United Kingdom, Germany, Netherlands, and France). Exodus' revenue mix consists of (based on Income Statement of the first quarter of 2000):

- Server Hosting services (40%),
- Internet Connectivity services (40%)

- Managed Services (20%).

The company has been able to capture a significant portion of high-performance Web sites into its IDCs and is expanding to international markets. The company provides services for Internet centric businesses and large enterprises (i.e. Yahoo!, eBay, Gateway, Nordstrom and the Virgin Group). Exodus' facilities provide hosting of servers in a highly secure location, where there are redundant power supplies, multiple backup power generators, and multiple fibre trunks coming into the data centre. 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 analyse 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 centre, Exodus owns a backbone that connects all data centres. The company also offers Internet access services at T1 speed (1.54Mbps) and DS3 speed (45Mbps) for a flat rate or usage-based rate. Exodus connects the customer's offices with the data centres.

Exodus is the leader in the co-location hosting market. The company offers Internet access, managed and co-location hosting services. The company aims at establishing a defensible competitive advantage in the market by being first to market with these services with a state-of-the-art network of data centres supported by robust backbone architecture. While this strategy seems straightforward, it will allow the company to establish barriers to entry into the market. In addition to the strategic initiative outlined above, Exodus has identified the following five primary objectives:

- **Establish Market Leadership and Brand Awareness,** by enhancing significantly its profile within the hosting industry. The company has launched its first major marketing program recently, aimed at enhancing its brand awareness in the business segment.
- **Enhance Managed Service Offering,** in order to attract customers that plan to outsource their hosting requirements. It is expected to generate high revenue per user as well as create more customer loyalty. Towards this objective, Exodus has enhanced its technical capability and has made several acquisitions.
- **Accelerate Network Expansion,** both domestically and internationally, in an attempt to establish a full presence in each of the primary Internet centres around the world. Exodus will add 3 sites in Europe and Asia, allowing it to meet the growing demand for complex Web hosting facilities internationally.
- **Leverage Technological Know-How,** by spending 3-4% of its total revenues on product development in an attempt to add value to its existing client base and to address new market opportunities. This has led the company to offer enhanced Web hosting products, as well as services to support software application hosting and e-commerce offerings.
- **Establish Strategic Relationships,** in order to complement its core areas of expertise. Recently, the company teamed up with Inktomi to deploy the company's Traffic Server network caching technology across Exodus' network of IDCs, moving frequently accessed data closer to end-users and improving response times for page requests. Exodus' plan includes resellers, solutions integrators, technology partners, and alliance partners.

According to the stakeholders typology identified in Section 3.3, Exodus is a connectivity provider that incorporates business activities of backbone provider, access provider and data centre. Exodus provides network services, broadband access and backbone connectivity to business end users. Exodus also provides co-location hosting services.

Based on the description of Exodus business profile, the business relationships model with other stakeholders in the Internet marketplace is presented (Figure 9).

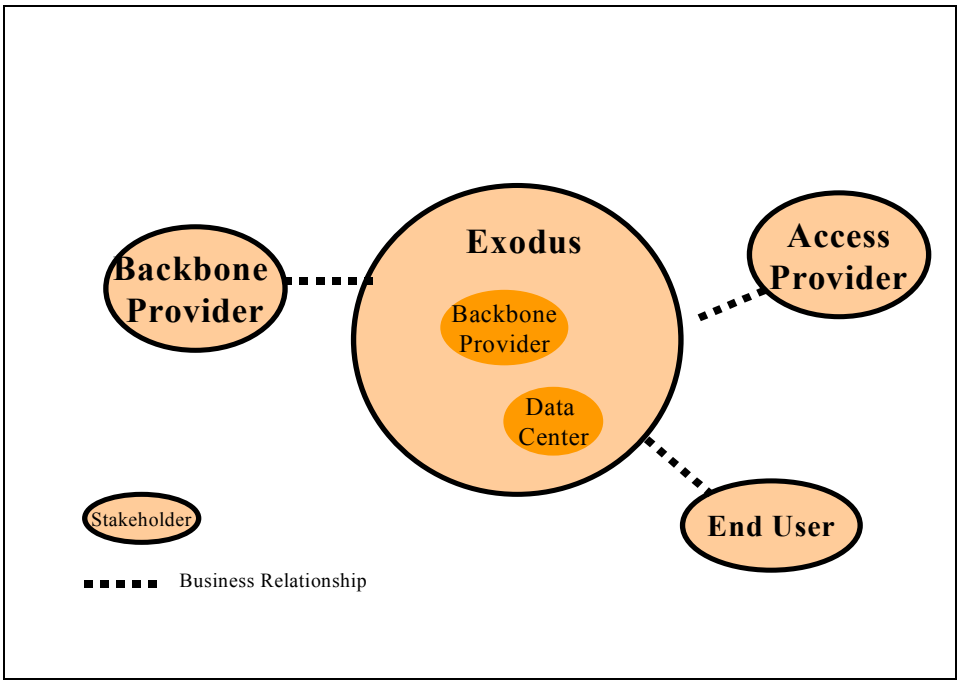

Figure 9: Exodus Business Relationships Model

The Exodus Business Relationships Model (Figure 9) presents two stakeholders: a backbone provider and an end user. According to the service delivery processes the value flows between the stakeholders involved with Exodus are identified:

- *Backbone Provider-Exodus*: this business relationship concerns the provision of network services. As both incorporate the backbone provider role, the exchange of services between them includes interconnectivity and transport services. Exodus has both peering and transit agreements. Exodus has established 154 public and 48 private peering arrangements giving it clear access into the Internet;
- *Access Provider-Exodus:* this business relationship concerns Exodus provision of wholesale services, universal access and connectivity to access providers. In such cases the access provider is paying Exodus according to the type of interconnection agreement that they have (fix amount versus usage based pricing);
- *End User -Exodus*: this business relationship concerns Internet connectivity and application services provision. According to Exodus revenue mix, 40% comes from server hosting, 40% from Internet connectivity and 20% from managed services. In the case of Exodus end-users are business customers.

5.2.5 Akamai

Akamai is considered both as connectivity and information provider, according to its core business activities. Akamai was founded in August 1998 and started to operate in

April 1999. Akamai has limited meaningful historical financial data. Akamai provides global delivery services for Internet content, streaming media and applications that improve Web site speed, quality, reliability and scalability and protect against Web site crashes due to demand overloads. Akamai markets its services to business segment. Akamai deliver services web content and applications through a worldwide server network by locating them geographically closer to users. In 2000, Akamai acquired Network24 Communications, and INTERVU in order to accelerate its market leadership in streaming media. There are no quantitative data available on Akamai's revenue mix.

Akamai entered into a strategic alliance with Apple Computer in April 1999. Sales of its service to Apple Computer represented approximately 21% of total revenue for the first quarter of 2000. Apart from Apple, Akamai entered into strategic alliances with Cisco Systems, in August 1999 and with Microsoft Corporation in September 1999. Under each of these agreements, Akamai is seeking to jointly develop technology, services and/or products. Akamai has been licensed from MIT various patent applications and copyrights relating to Internet content delivery technology.

Until now all of Akamai's revenue has been derived from customers based in the United States. Akamai's revenue is expected to increase through indirect distribution channels and new European market. Akamai currently provides a FreeFlow service guarantee that its networks will deliver Internet content 24 hours a day, seven days a week, 365 days a year.

The average selling price of Akamai's services as measured in dollars per Mbps, exceeds Akamai's average cost of bandwidth. While gross margins are expected to increase over time, fluctuations are possible as fixed costs increase due to the rapid expansion of Akamai's global network of servers. Akamai's services are used in conjunction with larger networks involving sophisticated hardware and software products supplied by other vendors. Each of Akamai's customers' networks involves different combinations of third-party products.

Currently, Akamai's future growth depends on the commercial success of its Internet content delivery services and other services and products it may develop and/or offer. The future revenue growth of FreeFlow Streaming will also depend, in part, on customer acceptance of a combined or integrated Akamai/INTERVU service offering. In addition, Akamai promotes any portion of its technology as an industry standard by making it readily available to users for little or no charge.

Akamai competes in markets that are new, intensely competitive, highly fragmented and rapidly changing. Akamai has experienced and expects to continue to experience increased competition. Some of Akamai's current or potential competitors may bundle their services with other services, software or hardware in a manner that may discourage Web site owners from purchasing any service Akamai offers or Internet service providers from installing Akamai's servers. Akamai may face competition from other providers of competing Internet content delivery services, including networking hardware and software manufacturers, content distribution providers, traditional hardware manufacturers, telecommunications providers, software database companies, and large diversified software and technology companies.

According to the stakeholders' typology identified in Section 3.3, Akamai is a connectivity provider that incorporates business activities of application service provider and data centre. Akamai provides application services, to business end users. These services are provided through leased networks. Akamai also provides fast content and streaming media delivery.

Based on the description of Akamai business profile, the business relationships model with other stakeholders in the Internet marketplace (Figure 10).

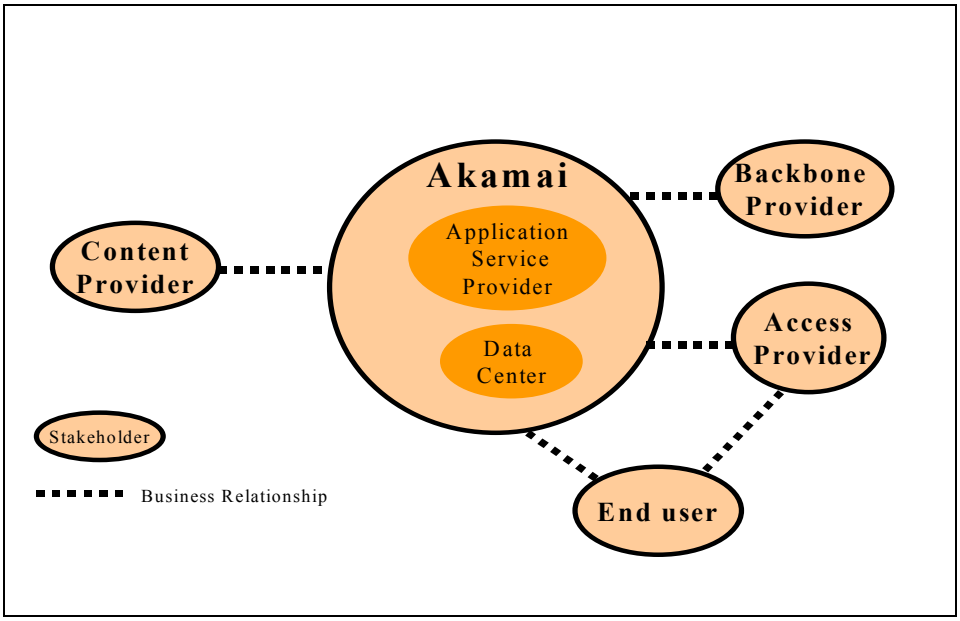

Figure 10: Akamai Business Relationships Model

The Akamai Business Relationships Model (Figure 10) presents four stakeholders: a backbone provider, an access provider, a content provider and an end user. According to the service delivery process the value flows between the stakeholders involved with Akamai are identified:

- *Backbone Provider-Akamai*: this business relationship concerns the provision of network services. Akamai has to connect their servers to several backbone networks in order to be able to efficiently provide its services to end-users;
- *Access Provider-Akamai*: this business relationship concerns renting of space for Akamai cache servers in the central offices of the access provider and connect them to the network of the access provider. Akamai's operations are dependent in part upon transmission capacity provided by third-party telecommunications network providers. Any failure of such network providers to provide the capacity Akamai requires may result in a reduction in, or interruption of, service to Akamai's customers. Akamai enters into contracts with third-party network providers with terms typically ranging from six months to three years. These contracts may commit Akamai to minimum monthly fees plus additional fees for bandwidth usage above Akamai's contracted level.
- *Content Provider-Akamai*: this business relationship concerns customised service agreement with content providers according to their requirements. The services may include global delivery services for Internet content, streaming media and applications that improve Web site speed, quality, reliability and scalability and protect against Web site crashes due to demand overloads. Akamai derives its revenue from the sale of its FreeFlow and FreeFlow Streaming services and other services under contracts with terms typically ranging from 12 to 36 months. Akamai´s revenue is based on fees for the amount of Internet content delivered through its services. These contracts also provide for minimum monthly fees.

In this case a content provider is customer of Akamai products and services. Usually they resell the services to their end-users. Akamai customer base includes only business customers. The main customer of Akamai is Apple. End users are typically billed monthly in advance for minimums and monthly in debit for usage above the minimums. Akamai also derives revenue for implementation, installation, usage and other fees. If Akamai does not provide this service, the customer does not pay for its services on that day.

- *End User-Akamai:* this is an indirect business relationship does not include any money transfer. It only concerns the delivery of the content to end-user through the provision of specific performance guarantees. These guarantees are however, paid by the content provider, as they are value added to the content provision service offered to end-user.

6 Structure of Competition in the Internet Marketplace

6.1 Positioning the Internet Marketplace

There is a relation between technology advances and business opportunities because both forces affect the same business model. However one of them is prevailing, and characterise the path that a company will follow when positioning itself in the marketplace.

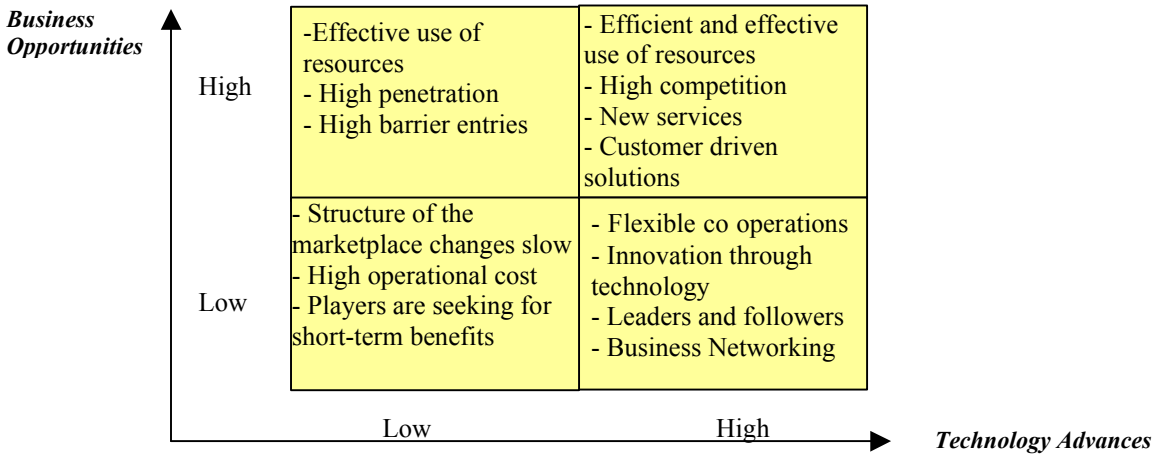

Figure 11: Marketplace Positioning Framework

Figure 11 includes some basic characteristics [9]. This classification will be used in order to effect a taxonomy of the Internet marketplace. Ideally, every marketplace objective is to position on the upper right quadrant, where the business and technology are harmonised in an efficient way. The balance of technology and business is making a series of benefits and threats. Each quadrant describes different generic market states. According to the scope of Project "M3I", only the benefits are highlighted:

- ***Low Business Opportunities-Low Technology Advances:*** total value gain at the model has not changed for a long period. No remarkable changes have been noticed. The evolution of value is coming to a deadlock, representing an overall uncertain situation;
- ***High Business Opportunities-Low Technology Advances:*** business opportunities are defining the amount of value. One or more sectors that participate in the value chain is (are) growing very fast due to various reasons that are invisible to the whole value chain. The rapid growth is increasing dramatically the barrier entry only to the specific industries. As a side effect, the other industries must develop a sophisticated way of working and co-operation, thus effective use of resources is a critical factor for participating in the value chain.
- ***Low Business Opportunities-High Technology Advances:*** rapid development of new technologies could act as a horizontal force that will affect the way of co-operating. Information and communication technology can lead to radical changes, not only within the firm, but also between companies and customers. The business models form part of the complete organisation of the business network, consisting of relationships between suppliers, customers and business

intermediaries. The idea of acting in a network will consequently classify leaders and followers, in a way that if an organisation participates at a network is a leader and if not is a follower. In that case network is defined as a collection of intermediaries business entities. Thus the functionality of the network defines the amount of value.

- ***High Business Opportunities-High Technology Advances:*** this quadrant is proposing an ideal situation, where strong competition force all the firms and industries to be organised in an efficient and effective way. On the other hand the differentiation of product and services across industries and markets acts like a switch, defining whether or not a firm will participate on the value chain. All the companies at this case are in alignment with customer needs.

Based on the presented taxonomy, the way to gain higher value is to invest in new technologies or get a great business opportunity. According to Scott Morton, a higher level of value could be gained through a technology push and a market pull [10].

If a company tries to increase value in its products and/or services, only through technology (technology push) without taking into account the needs and the rules of the market, then it may not be able to increase the value at a desired level, because the market pull will not allow it. Vice-versa, if an organisation tries to increase value only through market pull then technology restrictions possibly will postpone this goal [10]. In the example of M3I it is not only the technology dimension that will characterise the platform as valuable but also the needs of the market referring to the platform itself. Generally, it is preferred to start examining one dimension (either technology or market) and later move to the other.

Considering the taxonomy two alternative paths exist. The first path aims to achieve higher value through market pull, thus business opportunities should exist. The path ends with the adoption or development of new technologies. The alternative path considers that the technology push raises first and the value and the market pull follow afterwards. This means that the shift to the highest quadrant of value passes through the technology advances axis and later through the business opportunity axis. A prerequisite for this path is the existence of technologies and similar paradigms form other business activities (Figure 12)

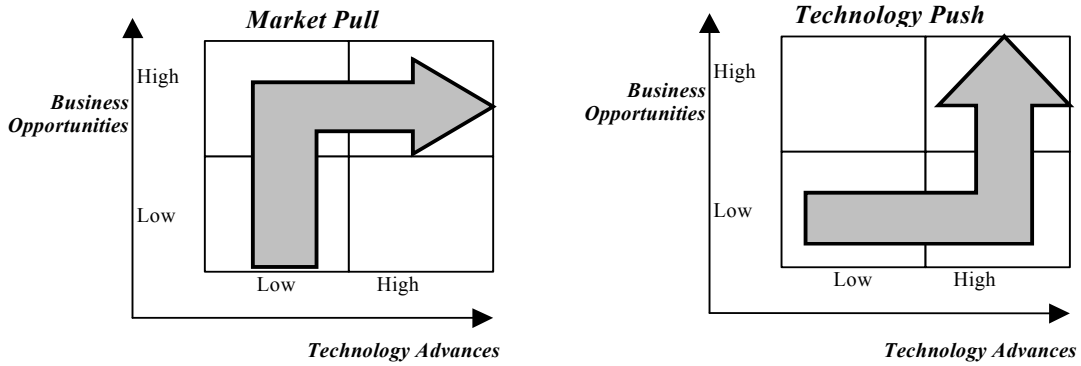

Figure 12: Alternative Paths to Increase Value

6.2 Positioning ISP Paradigms in the Marketplace Framework

The market for Internet Service Provision is characterized by many market driven business opportunities. New market dynamics in a highly competitive environment support the provision of new services and applications as well as the entrance of new players from different industries.

We analyse the strategy of the five ISPs case studies, in the context of exploitation of new business opportunities versus technology advances (Figure 13). Based on their business profile it is observed that their strategy is based either on exploitation of business opportunities, or on technology advances that the Internet marketplace generates, which however are accompanied with high investment risks.

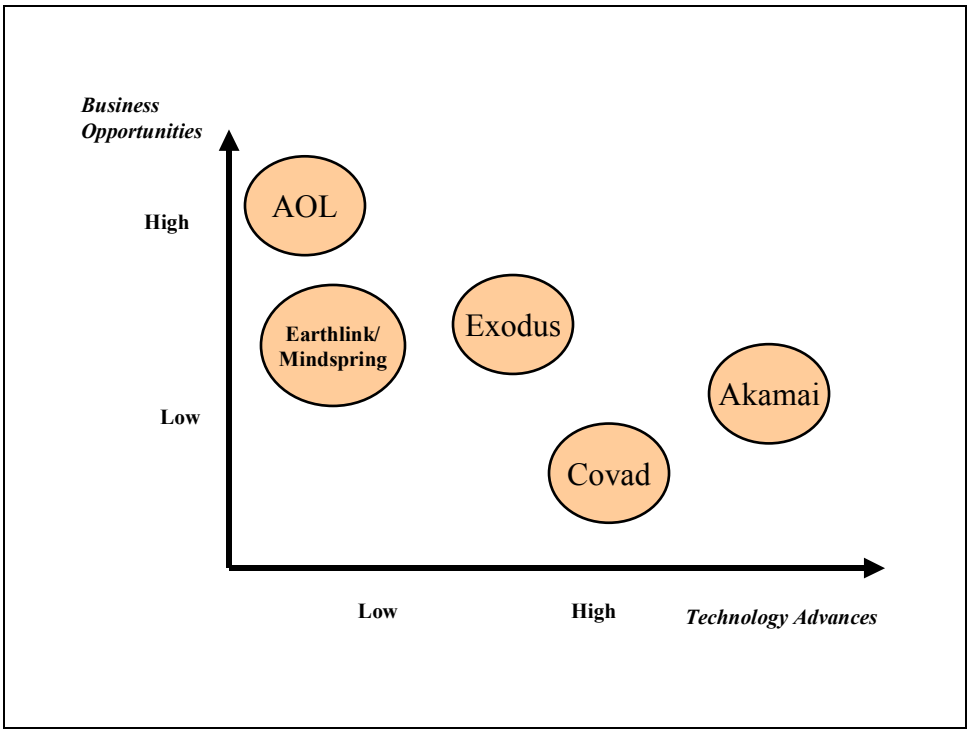

Figure 13: Position of ISPs in the Internet Marketplace

Market Pull Path

In particular, in the **AOL** case the market pull path is observed. The strategic objectives of the company is to provide bundled services to its residential customers (Internet access, content, interactive content and retail Internet products) and exploit its customer base by selling advertising services to its business customers. AOL does not exploit technology advances but is focussing on expanding the scope of its business activities. AOL creates value added by satisfying customers' needs and exploiting business opportunities.

In the **Mindspring/Earthlink** case the market pull path is observed. The new company appeared due to the merger of two ISPs well positioned in network services provision. The new company aims to extensively exploit business opportunities in the area of web hosting, content provision and broadband access provision. The Internet marketplace generates business opportunities and technology advances lead the company to provide new services in broadband access. However the strategic objectives of the company are showing a shift to new business opportunities base don customer needs.

In the case of **Exodus** the market pull path is observed. The strategic objectives of the company concern exploitation of business opportunities that derive from the increased demand for server hosting services, especially from business customers. To this end the company is focusing on establishing a leading position in server hosting service provision, which may be considered as a niche market. This will expand the activities scope of the company and generate high market revenues.

Technology Push Path

In the case of **Covad** the technology push path is observed. Covad is exploiting the technology advances in connectivity and transport services. Covad is offering DSL and VPN services mainly two business customers. Covad's strategy had led to high investment costs and low penetration rates. However the company expects to recover sunk costs from the new market for VPN and DSL services.

In the case of **Akamai** the technology push path is observed. Akamai is exploiting technology advances in streaming media and improving network performance. Akamai sells very innovative services and is expecting to create a new market and dominate it. Its strategic plan involves very high investment costs and is condition to market uncertainties.

6.3 Analysis of Competition in the Internet Marketplace

The Internet penetration in both business and consumer sectors is rapidly increasing in most European markets. The main trends currently affecting the degree of competition in the Internet services provision are the increasing demand of businesses for Quality of Service (QoS), and the accelerating growth in the demand for value-added services.

European ISPs in operation can be broadly classified into three groups, according to their size and the geographical scope of their operations:

- *Local/Regional ISPs*: between 60% and 80% of Europe's ISPs are very small operations with subscriber bases of only a few hundred. They typically have a localised presence, although in some markets where virtual points of presence (VPOP) services are easily obtainable they may offer national coverage. This type of ISP owns limited infrastructure and tends to focus on the provision of basic connectivity to the residential market;
- *National ISPs*: a smaller number of the ISPs in Europe are national operators with subscriber bases ranging between a few thousand and several hundred thousand. This type of ISP will usually own a nationwide point of presence (POP) network and Internet backbone, although it can often be non-facilities based, and offer its services to both residential and business users;
- *Pan-European/International ISPs*: the smallest group of ISPs comprises operators with an international focus, either pan-European or global, with subscriber bases ranging between 50000 and several million. This type of ISP may be either facility based or non-facility based and will tend to specialise in the provision of services to either the residential or business sector.

The first commercial providers of Internet services were the independent ISPs, which grew out of the companies responsible for managing and servicing the networks used by the research communities that originally founded the Internet. These began by offering connectivity and Internet transport services over networks composed of self-owned POPs connected by lines leased from telecom operators. They have been joined by a large number of organisations from different backgrounds, including [1]:

- Online service providers and content-based ISPs, such as AOL-Bertelsmann, CompuServe;
- Incumbent Telecoms, such as BT, Deutsche Telekom and Telia;
- New-entrant Telecoms, such as Level 3, Qwest and Tele2;
- Cable operators, such as A2000, NTL and Telenet;
- IT companies, such as IBM, Microsoft and Mitsubishi;
- Brand-driven ISPs, such as Freeserve and Virgin Net.

These various types of operator are adopting different roles in the supply of Internet services to end users, broadly in accordance with the distinct sets of strengths they bring with them from the backgrounds from which they have emerged. These roles are subject to continual fluctuation.

The number of ISPs is still growing, yet in the long run Europe cannot sustain all companies currently in operation. Most of the factors encouraging market growth are short or medium term. As economic and commercial forces begin to slow down, and demand for Internet services becomes saturated, the supply side of the Internet access market will become considerably more concentrated over the next few years. Alongside the growth of new players, a great deal of industry consolidation has already taken place. Emerging telecom operators and incumbent Telecoms have acquired most of the pioneers ISPs on commercial Internet market.

Factors that are driving consolidation within the ISP industry include:

- *Increased price competition:* ISPs that have built large and loyal subscriber bases and achieved economies of scale are beginning to compete aggressively on price;
- *Greater bargaining power:* ISPs with large and high-quality subscriber bases have increased bargaining power with advertisers, content providers and network operators for traffic revenue-sharing agreements;
- *High traffic volumes:* ISPs that have substantial subscriber bases generating large amounts of traffic are also able to secure lower-price international bandwidth and interconnect rates, as well as reduce the unit costs of transmission.

In order to provide an analysis framework ISP's choice is considered as an attempt to differentiate from competitors. Firms may try to push technical frontiers, develop local or national brand names, combine recent technical advances with less technical businesses and so on. Such differentiation may arise as a response to firm-specific or user-specific assets, and these returns may be temporary if competitors eventually learn to provide close substitutes.

Additional factors that lead to changes in the ISPs market are:

- *Local call traffic revenue-sharing agreements:* when ISPs can obtain a cut of the local call revenue, the incentive is to maximise the amount of traffic flowing over one's network, and for ISPs to merge with national Telecoms;
- *Rising marketing and sales costs:* as organisations begin to generate more revenue, they are intensifying the marketing operations and introducing more standard sales channels, making it harder for newcomers to compete;
- *Raising demand for quality of service (QoS)*: as there is a need to offer end-to-end network management to large corporate clients;

- *Diversification:* business customers want a broad range of communications services. By offering a complete portfolio, providers are maximising their revenue streams. [1]

There are currently three main types of player in operation in the business sector: large IT solutions providers, incumbent and new-entrant Telecoms, and independent ISPs. All of these organisation types are seeking to leverage the skills they possess to carve themselves a sustainable position in the market.

The large IT solutions providers such as Andersen Consulting, EDS, GEIS and IBM are seeking to exploit their experience in operating their own intranets and their expertise in designing end-user systems and IT-based approaches to business problems. With the exception of IBM, the large IT solutions providers have not traditionally been involved in the provision of Internet services and are still positioning themselves in the market. In addition, most of them now focus primarily on the large corporate and multinational business sector, leaving a good deal of untapped demand in the SME sector. This allows smaller players able to offer customised solutions and a localised presence to enter the market.

The large Telecom-owned ISPs such as BT, Carrier1, KPNQwest and Telia are best placed to develop the corporate and multinational market, leveraging their national and international infrastructures and economies of scale. Control of international networks enables them to provide integrated end-to-end intranet services for geographically dispersed multinationals, managing the networks so that they can differentiate themselves from ISPs that have to rely on other carriers through QoS and secure network guarantees. This will enable them both to save on costs and to attain higher margins by pricing their services at a premium.

Telecoms, which lack this kind of infrastructure, will have to concentrate on the SME sectors within their regional markets, and, while this is a potentially lucrative area, Telecoms are yet to develop their full potential in this direction. While incumbent Telecoms have been selling telephone lines to SMEs for many years, it is only very recently that they have developed products and services targeted specifically at this market, having preferred in the past to focus on the corporate and multinational sector. Because their traditional corporate and multinational clients usually have their own in-house technical expertise, Telecoms are inexperienced at offering the kind of ongoing and tailored approach required in the SME market.

New-entrant Telecoms have tended to compete primarily on the basis of price in the form of discounted telephony services. However, new entrants have been slightly quicker to perceive the opportunities offered them in systems integration than the incumbents, and they tend to be more comfortable with IP technology. Being smaller and more flexible organisations, new entrants are also better able to provide solutions tailored to the needs of particular customers and are more readily adaptable to fluctuations in their requirements.

In order to compete more effectively in the SME sector, many large Telecoms have carried out acquisitions or undertaken restructuring processes. Other Telecoms have formed alliances with companies that already possess expertise in the market. Cable & Wireless, for example, unveiled a new set of packaged services designed for the SME market in an alliance with IBM.

Among the independent ISPs, the remaining large pan-European providers are quite well placed to develop the corporate and multinational market, leveraging their national and international infrastructures and economies of scale, although the TO-owned ISPs

are likely to remain dominant. Given the underdeveloped state of the SME sector, and the fact that larger companies have not yet found cost-efficient routes into that market, smaller independent ISPs are well positioned to develop into niche players, building expertise in servicing local or sector-specific market segments. ISPs will have a marginal competitive edge over Telecoms in this area, as they will have already acquired many of the necessary skills from hosting and managing their own IP networks. In addition, the independent ISPs have already been quick to realise the SME market's potential, and the fact that many of them are SMEs themselves tends to make their customers feel comfortable dealing with them. Companies such as Easynet and ITG have been most successful in this market, and should be able to capitalise on this success over the next few years.

Given the trends in business segment, it may develop into an increasingly layered environment in which small players continue to exist alongside larger players, either as local resellers or as regional ISPs in their own choice. Competition will undoubtedly intensify in the coming years, as a result of the larger ISPs seeking to move into the SME market in search of higher margins and diversifying their portfolios. This will lead both to increased price and QoS competition.

However, many smaller operators should be able to survive by operating outside the core business areas of the capital cities where competition will be most intense and by focusing on vertical market sectors, providing specialist services to the finance, medical or educational sectors, for example. Those independent ISPs currently active in the residential sector, which do not wish to be acquired, are likely to migrate into the business market in search of these kinds of opportunity. Larger players will be able to benefit from this, as resale deals will provide them with new channels to market and increase the demand for their wholesale transmission services. [1]

6.4 Residential User Segment

Traditional ISPs within the residential sector need to find ways of ensuring that they do not become mere commodity providers of wholesale connectivity services, playing host to the consumer organisations that are capturing all the higher-margin revenues from e-commerce and content-related offerings. Several incumbent Telecoms are already seeking to avoid this role by offering their own consumer orientated web sites and e-commerce orientated portals. In addition, organisations from various areas of the consumer market are enhanced by the Internet to enter the market.

Within the residential sector, while the market is remaining quite diverse, the dominant players are the brand and content-based ISPs**.** The main sources of revenue for retail ISPs in this sector will change from access provision to advertising, e-commerce applications and paid content provision. In the emerging mass-market environment, the winners will be companies that are most skilled at marketing or selling their services and at managing large subscriber bases. At the network level, the main beneficiaries of this shift will be those organisations that operate large amounts of national infrastructure and are able to form stable wholesale and marketing alliances with the branded ISPs to increase overall traffic volumes on their networks. Smaller ISPs will either migrate to the business sector, or be purchased by larger organisations.

Competition between the brand-driven and content-based ISPs will be high over the near future, as they will compete on obtaining market share. Prices are likely to continue to decline. Companies appear increasingly prepared to risk significant present losses on the basis of expected returns from economies of scale that they expect to achieve and growth in revenue from sources such as e-commerce and advertising.

ISPs that do not possess flexible business models and resources to ensure the continued rapid growth, will encounter decline in their medium- to long-term earnings.

6.5 Business User Segment

Alongside the growth in demand for QoS among business users, there is a corresponding increase in demand for a fuller range of services as businesses seek to obtain the benefits of transferring more of their systems over to IP networks. For this reason, the business market now provides many more diverse opportunities for access providers than does the residential sector, enabling them to combine their basic connectivity offerings with potentially higher-margin services such as e-commerce solutions and systems integration. For the past few years, ISPs have tended to market their services to the business sector on a largely undifferentiated basis, but increasing competition is leading many of them to refocus their operations on particular horizontal or vertical market segments.

The growth of Intranets within the business sector is forcing ISPs to improve the QoS they offer and the degree of control they have over their subscribers' traffic. In order to achieve this, national Telecom-owned ISPs have deployed substantial IP backbone capacity over the last two years, and much of this is intended for private IP transmission, particularly from large multinational corporations, rather than for public Internet traffic. However, smaller ISPs, particularly the medium-sized, are also trying to turn managed Intranet services into a substantial part of their business. It is expected that even smaller business customers will increasingly require reliable connections with fast up-times for their business-critical applications [1].

The business segment is becoming a key area for ISPs that do not possess the required skills to compete in residential segment. Within this sector, concentration is likely to occur at the top of the industry. The balance of power will shift towards those bigger players, which own large amounts of infrastructure and are able to leverage the economies of scale available to them from this as well as to deliver high-level QoS guarantees. The advantages that appear from concentrating their activities will be significant incentives for companies to merge with or acquire the operations of other companies. At the lower level of the supply chain, there will be much more diversity, where smaller ISPs will be able to take advantage of their local/regional presence and offer solutions customised to sector-specific needs.

6.6 The Impact of UMTS on the Internet Marketplace

Universal Mobile Telecommunication System (UMTS) combines major innovations in radio access, including both new radio interface and radio access network technologies. This will allow fixed-mobile convergence on service and application level. UMTS creates a new market for global mobile seamless personalized multimedia communications and information services at high bit rates in wide and local area environments. Therefore, key players of mobile communications and Internet marketplaces are expected to invest in UMTS in order to exploit the emerging market opportunities, according to their core competence. Through the deployment of UMTS future mobile communications will combine personalized and universal services. UMTS is expected to create a virtual home environment, which defines the concept for portability of a personalized service environment across network boundaries and between terminals. In addition to this, the open service architecture will create increased freedom in service provisioning, and lessen the need for standardization, through the use of application building blocks.

6.6.1 UMTS Key Players

The development of UMTS access network (UTRAN) will need large investments in infrastructure that will be built from scratch. The existing access network infrastructure will have to be replaced. The UMTS core network includes two subsystems: the legacy voice call agent domain and the IP packet domain. The IP packet domain will not need to be replaced; yet it will need to be enhanced in order to provide QoS guarantees to support multimedia services.

From a horizontal perspective-UMTS services-the key stakeholders are expected to be:

- the *mobile operators* that own the wireless network infrastructure, and have large customer base on mobile communication services;
- the *ISPs* that also have network infrastructure, high speed (i.e. ATM) lines, and wide IP know-how, which may be integrated to the UMTS core network. They also have large IP customer base;
- the *content providers* that will be empowered as UMTS will provide the necessary infrastructure specifications for multimedia content and application wide use, as well as specialisation in personalized services provision.

From a vertical perspective when viewing the UMTS industry, there are two critical players that are expected to influence UMTS market evolution:

- *the mobile device vendors* (i.e. Nokia, Ericsson) that control mobile user interface;
- *the software vendors* (i.e. Microsoft) that control APIs and user interfaces.

As UMTS technology is not implemented yet, and no specific standards are formally adopted, the role of these two players will be critical, when investing on the technology that will be implemented to end user devices. Even if they do not directly participate on the future business models of UMTS service provision, they are expected to strongly influence the market evolution, by supporting or constraining UMTS services deployment to end users. If the vendor restricts the usage of the device by dedicating it at a certain mobile operator, it will restrict innovation and reduced competition. This development can be seen on the American mobile phone market, where the mobile phone is linked to a specific mobile operator. Changing the mobile operator requires the purchase of a new phone. If the vendor however provides devices, which enable the use of third party software on the mobile device, the end-user might be given the

power to select whatever service he wants. Even more, if the mobile device vendor enables the user to have more than one SIM card simultaneously, the mobile operators will lose their market power determined by "owning" the end-user.

According to UMTS Forum [29], the evolution of UMTS services market will create many business opportunities. Legacy and emerging stakeholders of the Mobile Telecommunication and the Internet markets will have different business relationships according to their core business competence and current market position. In particular, three business relationships models are expected to emerge.

In the *fragmented* business relationships' model each stakeholder remains a separate business entity and provides the same services as before the UMTS deployment. This model appears either due to high competition of existing key players in the new market, or during the initial phase of UMTS deployment. In this phase, the existing technology of mobile network infrastructure will still be used (e.g. GSM) since initial users will be limited, and there will be only small "islands of UMTS" in metropolitan areas.

As soon as the number of users increases the *cooperation* business relationships model may appear in order to minimise transaction costs by creating economies of scale. In such case the stakeholders will need to establish cooperation agreements in order to exploit the market opportunities that will appear as user demand will increase and new applications will emerge.

However, when UMTS becomes the new communication system, and UTRAN fully replace the GSM networks then the *ownership* business relationships model will appear along with the fragmented or cooperation ones. Under this model, one stakeholder (i.e. most likely the mobile operator) will provide both communication and information services.

6.6.2 Fragmented Business Model

In the fragmented business model all the stakeholders remain separate business entities. In this situation, the subscription and security data related to all of the involved operators and providers should be stored on the UMTS operator USIM (UMTS SIM card which adds UMTS-related extensions and provides compatibility for UMTS-GSM roaming) in order to simplify user access. Agreements would then be needed between all stakeholders that are involved in UMTS service provision (Figure 14).

The user will need to register with at least three different providers, the UMTS Operator, the Backbone Provider and the Portal Service Provider, to be able to access and manage content. In such case, the Internet becomes the most likely interconnection network between the different operator and provider domains. This means that the parties involved are able to choose completely different ways of handling mobility, QoS and security. The market segment of transmission and connectivity services (the Internet) will only be controlled by backbone providers, as it will be outside the reach of UMTS access and content providers. Thus, new pricing mechanisms will be needed to give backbone providers the incentives to cover the various QoS requirements of access and content providers.

A possible variation of this business model is the co-operation business model scenario the main stakeholders, UMTS Operator, Backbone Provider, Portal Provider co-operate. Medium term co-operation agreements will be necessary to achieve acceptable wholesale service offerings to the end-user. Such agreements will be based on contracts that have to be carefully designed in order to cover requirements of

stakeholders coming from different markets and having experienced different patterns of collaboration.

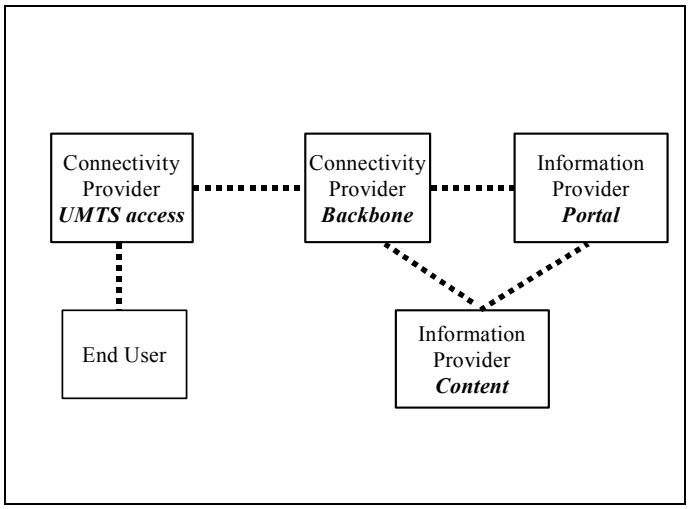

Figure 14: Business Relationships in the Fragmented Business Model

6.6.3 Ownership Business Model

In the ownership business relationships model the UMTS Operator provides bundles of services that include access, connectivity transmission and content services. In this case there is complete control both in UMTS access, as well as on the IP side, on transmission and connectivity services. The UMTS operator can decide autonomously which solutions for mobility, QoS and security control are the most suited to its business model, since all the nodes and networks involved are under its own control. In particular, mobility handling, QoS and security issues are eased by the fact that all the adopted solutions are known and designed to work together. The UMTS operator can also provide the user location information to applications and content offerings under its responsibility (Figure 15). All the related subscription and security data on the USIM module belong to the same legal entity.

From the end-user's perspective, this model restricts the selection of UMTS operators, portal service provider and content provider. The end-user has to go with the services offered within the services bundles. Whether the end-user will be allowed to access additional services will depend on the market power of the stakeholder running the ownership business model. The number of subscribers determines the market power of the stakeholder. If provision of additional services is allowed, the data of this service provider could also be stored on the same USIM.

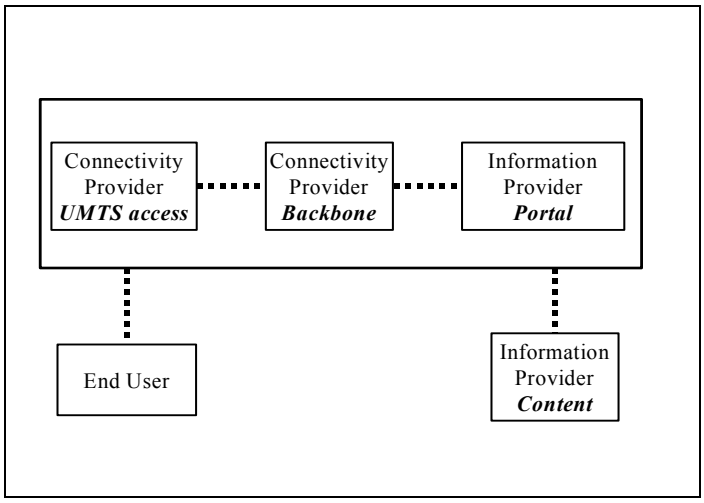

Figure 15: Business Relations in the Ownership Business Model

These business interrelation models will bring in direct competition mobile operators and ISPs that currently have large overlapping customer bases. They will either develop the same infrastructure to provide multi services to end user, thus become UMTS operators, or be forced to change their business scope. For example ISPs might be forced to provide content instead of network services.

However, as technology evolves mobile end users' devices may have direct access and instant connectivity to IP layer. In this case the end user may decide to ask for content from a different information provider thus only use the UMTS network provider for network services. In such case the value added that the UMTS network provider generates from its customers will decrease. Thus, the network provider will need to design new strategy in order to lock-in its customers to value added services.

In a simple example the UMTS network provider's strategy may guarantee QoS to its customers in services that he owns, but when customers are using services from other providers it may just offer best effort services. Another option involves different pricing mechanisms for services that are provided and delivered in its network or out of its network.

6.6.4 The Initial Phase of UMTS Deployment and Key Players

Mobile communication operators and ISPs are the main candidates for initial deployment of UMTS, which will provide high quality communication services and multimedia applications respectively. However they are expected to follow different paths. According to the UMTS Release 2000 [35], the evolution of GSM/Internet convergence will depend on business initiatives and maturing of enabling technologies (the access network (UTRAN) and the core network).

Many *Mobile Operators* have already invested on GPRS technology. They own mobile network infrastructure, which may be used for developing the access network of UMTS (UTRAN). According to the scenario of vertical collapse of standard-specific core network [35], it may incorporate a packet domain based on GPRS architecture. In this case the IP layer may be directly extended to the mobile end-user device. These factors give mobile operators a competitive advantage over new entrants in UMTS market.

ISPs own or lease fixed communication access network. UMTS technology will expand their business scope, by providing them enhanced technological infrastructure to develop and deliver multimedia content and new communication services. At the same

time they will establish a strong position in the new market. However, as they do not own mobile network infrastructure they will encounter significant fixed investment costs for developing UTRAN. This depends on the extent of ATM usage, as well as the development process of new IP mechanisms that may replace ATM in the UTRAN. With respect to core network according to the scenario of horizontal collapse of standard-specific core network [35], the integration with fixed network infrastructure will be closer to UTRAN, resulting a single radio mobile-specific packet service node. Concerning telecommunication service provision ISPs may exploit VoIP or VoATM technologies to offer new services to their customers and enter a new market segment.

6.6.5 Billing and Pricing in the UMTS Network

As telecommunications give ground to information delivered over IP infrastructure a new set of questions for existing billing the pricing mechanisms appears. The traditional elements that were billed in the world of telecommunications become irrelevant. “Time” dependent billing on the network will disappear quickly as customers get used to the idea that connections are “always on”.

Distance will disappear quickly, too – IP addresses are always “local”. The cost of transporting information and maintaining the network, however, must still be covered.

As described above there will be a number of different business models used. Each agreement between UMTS Operator, Backbone Provider, Portal Operator and Content Provider could be different. The key to an efficient billing process will be *flexibility and scalability*, as the volumes of billing data being filtered by mediation devices will highly increase from today’s levels.

The different elements that will be billed in UMTS networks include transport and content, and the different stakeholders that will pay include both corporate and residential customers. This increasing complexity will need to be addressed, so that the customer observes both clarity and simplicity in the bill. QoS is likely to feature in UMTS billing, with QoS discounts needing to be considered. Overall, information will be collected from a wide range of network elements, increasing the need for accuracy in inter-network transactions.

The fundamental billing issues being addressed are [29]:

- Linking the detailed IP records (IPDR) from the transport and content layers, to ensure that correct accounting can take place;
- The continuing use of pre-paid accounts, which will demand real time metering, or real time mediation methodologies, and is complicated by the uncertainty of estimating how long a session will last. It will not be acceptable to “cut off” a session during premium services delivery;
- Roaming, which will require both the delivery of personalised services whilst on a “visited network” and localised services, such as directories. Pre-paid roaming requirements will need to be addressed;
- Quality of Service issues, which are being addressed by billers, mediation companies and network equipment manufacturers;
- Interconnect agreements, which will become more complex when, content delivery and accounting is considered;
- Access to and usage of customer data. This needs careful attention, in the light of national regulation;

- The impact of IP addresses.

In the ideal UMTS world, users would be able to use local services wherever they are. Service value will become important as in roaming contracts and additional services have to be added in the charging record format that is exchanged between operators.

6.6.6 The Case of NTT DoCoMo

DoCoMo is a Japanese mobile operator, the subsidiary of NTT (Nippon Telephone and Telegraph). Except from the mobile communication services, DoCoMo also offers access to the Internet through i-mode system, which enables packet transfers and allows subscribers to be always on-line.

Currently DoCoMo has 16m subscribers (50,000 new subscribers per day). It has established many collaboration agreements with content and application service providers “Alliance Partners” that have increased both its customer base and its total revenue. 10,558 content providers have created i-mode compatible content. 482 application providers and e-commerce companies sell products and services to i-mode subscribers. Revenue streams involve both mobile communication and data transfer (pricing per packet transferred) services. From alliance partners DoCoMo gets advertisement fees and commission (9%) on every commercial transaction that is taking place through i-mode.

In the Internet marketplace, DoCoMo business relationships model is similar to the generic ISP business model. However, there is one main difference: DoCoMo controls Internet access, but the generic ISP does not. A content provider who wants to access DoCoMo subscribers has to incorporate i-mode technology on its web page.

7 Introduction of "M3I" New Roles and Services in the Internet Marketplace

In Project "M3I" Deliverable 1 "Requirements Specifications" [31] some special relations between stakeholders involving interactions between the business policy functions of their roles, were described. These interactions fulfil some important needs in an Internet with various yet unspecified pricing models, and various interconnect relations between stakeholders. By integrating these interactions into the previously described roles, a number of new stakeholders in the Internet market may arise, whose business is to simplify underlying Internet service prices and resell them in some sense, thus mediating. In the following three sections we three roles are briefly presented.

7.1 The Dynamic Price Handler

The function of the dynamic price handler (DPH) is mainly to automate a single end-customer's reactions to dynamic connectivity charges, according to some customer strategy.

The DPH has a relationship to three roles, typically a connectivity provider, an end-customer and an application provider. It transforms dynamically varying connectivity provider-charges into a total charge by dynamically varying service classes according to the end-customer's strategy. The term "variation of service class" may mean many different things depending on the price and service model, e.g. choosing a diffserv type of service, a priority level, the bid in an auction, or simply transmitting at another bandwidth.

The DPH can be implemented as an intelligent agent e.g. in the gateway equipment (e.g. residential gateway) of the customer. Its main objective is to solve a dynamic optimisation problem for the end customer. By combining the inputs: end user preferences and willingness to pay as well as (dynamically varying) prices and/or (dynamically varying) service classes it makes choices on behalf of the customer.

Control of the dynamic price handler can be a key strategic asset for a stakeholder. Control of the dynamic price handler may be compared with the control of computer based air ticket reservation systems. An airline with control of the ticket reservation system controls the search algorithms and can e.g. make sure that the system is biased in a favourable way[3]. Similarly a player with control of the algorithms in the DPH can bias it in its own favour. Furthermore, a player controlling the DPH in e.g. the content segment can gain control in the connectivity segment. Even though the DPH represents a potential for becoming such a strategic asset, it is not evident that customers will accept biased DPHs unless the biased DPH has some advantages outweighing the alternative. In the case of the ticket reservation systems economies of scale is the major factor for travel agencies when choosing reservation system.

7.2 The Risk Broker

The function of the **risk broker** is to create a "few" transport services with "simple" end-to-end prices, from underlying connectivity provider services with highly varying prices or service qualities.

[3] Competition authorities are aware of this problem and is typically trying to regulate such behaviour.

In an environment with a network infrastructure that offers no QoS/price guarantees, but where users nevertheless have the possibility to dynamically adapt to price or quality signals, it may still be possible to offer service and or price guarantees to users by introducing brokering at the network edges. The risk broker is part of the service policy function of a stakeholder performing this task. The role of such a stakeholder involves risk brokering and clearing, and it interfaces one or more paying parties (typically end-customers), one or more parties to be paid (typically connectivity providers generating dynamic prices), and possibly an application/content provider.

The risk broker function takes part in the service provision of mediating between more traditional services and dynamically priced network services. The risk broker offers a list of transport services and attached charge (or a tariff, depending on the service) to its customers before or at the *beginning* of the session, at its own risk. This charge is to be paid by the paying party.

The business case for a risk broker can be based on a model similar to insurance companies. Traditional insurance companies are pooling risk from many agents e.g. insurance against houses catching fire. The business model is based on risk aversion of the single agents. For example, if the cost of a bad event is c (a fire) and the probability of this event is π then the expected cost is πc. The insurance company can only make a profit if the willingness to pay for insurance exceeds this expected cost (which indeed is the definition of risk aversion). Similarly if the expected price of a communication session is p then a risk broker can only make profits if a customer is willing to pay an amount exceeding p in exchange for insurance against a high prices.

It follows from the discussion above that if customers are risk neutral then risk brokers have a bad business case. Risk aversion is however not sufficient. A customer frequently communicating over the net can pool its own risk over the sessions he is involved in. Consider for instance the case of a customer that pays a dynamic price for usage being billed once a month. On this monthly bill many communication sessions are aggregated and it may be the case that the customer each month pay an amount very close to the expected bill given the usage. Whether a risk-averse customer prefers to pay a dynamic price or to be a “self insurer” will depend upon the distribution of the dynamic price and in particular whether there is a small but positive probability attached to the event that the dynamic price becomes extremely high.

7.3 The Clearinghouse

The **clearinghouse** task can be viewed as a special aspect of the business policy function generally associated with a role. IP-sessions may generate two or more bills, one for the sending end, and one for the receiving end. The task of creating an IP-session with *one* price, which may be bundled with an application or which may be distributed in arbitrary manner among the end-customers, is the function of “clearing”. The action of clearing involves two or more paying parties and two or more parties (typically the end-customers’ Connectivity Providers) demanding payment of a certain amount by the customers. The clearinghouse collects the demands from the parties to be paid, sums the demands, collects the percentages of the total amount each customer is willing to pay, and announces to each paying party the amount to pay.

The clearinghouse sums up incoming charges and distributes the sum to the paying parties, *after* communication has taken place or on-line, during communication. The clearinghouse expects all paying parties to pay the agreed share of the total cost of communication without repudiation. Note that the total cost of communication may not be known beforehand.

A clearinghouse in its basic form does not take on the responsibility for the services provided to the paying parties. A natural function of the clearinghouse is the distribution of payment back to the parties to be paid. This means that the parties involved need to agree on a common mode of payment: exchangeability of currencies, agreement on set of credit cards or form of micro-payments. A clearinghouse may also typically reduce the cost of multiple transactions, by batching up funds transfers to its regular customers and suppliers (the Connectivity Providers and big Information Providers).

As indicated above, the basic function of a clearinghouse is to sum up incoming charges and distributes the sum to the paying parties. The need for clearinghouse functionality can be expected to increase as communicating parties start to share a volume based cost of communication (see e.g. [30]). A necessary condition for commercial success in this role is that the clearinghouse is trustworthy by the parties involved in the transaction. A paying party is not willing to transfer a payment to the clearinghouse unless he trusts that the clearinghouse indeed transfer the payment onward to the receiver(s). Traditional means of establishing trust is not applicable on the net (signatures id cards etc) and as a consequence institutions like trusted third parties (TTPs) are established. The economics of TTPs is in the domain of e-commerce and outside the scope of the M3I project. Accordingly in the following it is assumed that such mechanisms are in place.

A clearinghouse as a separate business entity will only make money if some stakeholders are willing to pay for the specific clearing services. Thus a clearinghouse needs a core competence or to possess strategic assets different from other players. Economies of scale on the demand side (network externalities) may be the most important strategic factor for a clearinghouse. Consider the simplest case where there is a buyer transferring funds to a seller. Transaction costs will then be minimized if these stakeholders have a relationship with the same clearinghouse as opposed to a situation where either two clearinghouses are involved or one of the parties has to establish a new clearinghouse relationship. If the example is extended to a multiparty transaction costs will compound. Thus in a multi-provider environment transactions costs for all stakeholders will be lower with a limited number of clearinghouses as opposed to very many. It follows that if a clearinghouse, for some reason, is large it can make money from reducing transaction costs for all stakeholders.

8 Impact of M3I Technology on the ISP Market

M3I technology will bring technology advances in the ISP market. It will enable ISPs to highly customise their services and to offer more sophisticated pricing of their services. Although it is not quite clear at the time being what to charge for, where and what to meter, or which pricing plan is appropriate, the M3I technology will create new business opportunities in this market by providing the means of implementing any imaginable pricing plan.

M3I technology aims to provide a set of generic pricing, accounting and charging mechanisms at the network layer, which will enable the ISPs to charge for the usage of their network resources. This will give them the capability to offer differentiated services (in terms of QoS) to their customers and make efficient use of their infrastructure. These mechanisms will enable the provision of more sophisticated services at the upper layers, facilitate bundling network and information services, as well as customised applications according to specific individual's needs.

Behind the usage based pricing - and particularly dynamic pricing - approach lie some important tensions as presented in the Requirements deliverable [31], which are the main points of debate between those that agree with the M3I approach and those that believe that over-provisioning and simple pricing policies (like flat-rate) would be adequate to support acceptable QoS at the network layer.

The basic M3I contribution is the development of pricing mechanisms, which will enable the provision of differentiated services in the Internet with the least possible changes in the network infrastructure. The goal is to give the right incentives to the customers for the efficient use of the network resources avoiding complicated mechanisms at the core of the network but instead place all the intelligence at the edges (following the current Internet philosophy).

Pricing could play the role of a very efficient call acceptance control and resource allocation mechanism. Users who value the service more will always get more regardless of the state of the network. In case of flat rate pricing this is not possible because if "static" QoS guarantees were given, the CAC mechanisms would prevent a user entering the network when it is full, even if he has more value than those already accepted.

Dynamic pricing (or congestion pricing) as a concept is extremely powerful because it enables numerous business models to be built on top of it. It provides the flexibility to create any pricing policy according to the specific needs of each ISP. Stable pricing is very restrictive in the sense that it doesn't give the ability to adopt different pricing policies if needed. It is obvious that if dynamic pricing mechanisms are in place (and in M3I it can be proved that the cost for doing that is very small compared with the flexibility that it offers), they do not pose any restriction in the deployment of stable pricing policies.

The M3I consortium believes that the numerous advantages of dynamic pricing (flexibility, efficiency, scalability, etc) and the ability, that current research has provided; to implement such policies using simple (but sophisticated) end-to-end mechanisms [34] makes it a very powerful candidate for the future Internet pricing policy.

Of course dynamic pricing does not come for free. The main drawback is the variability of prices, which may annoy and discourage end users who seem to value predictability

of charges much [33][32]. On the other hand, they value as well the QoS differentiation and are willing to pay for it.

This is exactly the gap that the new roles that M3I has introduced (Section 7) try to fill. Dynamic price handler and risk broker have the responsibility to present to the end-users meaningful and predictable service contracts while the clearinghouse will handle the settlement of the payments for each service.

Together with the emerging Internet QoS technologies (DiffServ, IntServ), M3I will experiment with approaches that are based in the congestion-pricing concept. A number of scenarios will demonstrate the different charging models that an ISP could adopt in order to offer more attractive services to his customers using the generic pricing mechanisms that M3I technology is developing.

The introduction of this flexibility will impact existing business models of stakeholders, including the value proposition chain, the business relationship with other ISPs, and the competition between the ISPs.

In the following subsections, some possible changes in the business models of ISPs are indicated.

8.1 Pricing of Services

Reconsidering the business relationship between the stakeholders (Figure 4), the interfaces where usage-based pricing will be important in the future can be determined. The interfaces between information service provider and data centre provider as well as between data centre provider and backbone provider are eligible. Those stakeholders (businesses) need flexibility in order to be competitive in the market. The interface between the end-user and the access provider is also eligible. However, there is a strong demand from end-users for highly predictable prices.

Information service providers will profit from usage-based pricing of differentiated network services offered by data centre providers. This will give them the mean to bundle different network services with different information services that they are providing to end-users.

Data centre provider can reduce their network costs by allocating resources to their customers according to their customers' needs and their willingness to pay. By offering customized pricing plans, data centre provider will be able to charge information service provider according to the consumption of resources as well as the congestion they are causing.

Access and backbone provider can use M3I technology to differentiate their network services and can deal with times of network congestion. They will be able to charge their customers according to different models (receiver pays model, the sender pays model, or a combination of both models).

End-users will benefit from usage-based pricing since this will give them the flexibility to meet their needs at a certain time of day or when performing a certain kind of task.

8.2 Predicted Changes in the Business Models of Key Players

Two examples of how key ISPs could deploy M3I technology are presented, AOL and Exodus. AOL is of interest since it offers complete Internet service to end-users (see Figure 6). Exodus is chosen since their goal is to offer end-to-end quality to information

service provider by providing data centre services and backbone services (see Figure 9).

AOL

Deploying M3I technology, AOL could position itself as a risk broker (see Section 7.2) since it takes on roles as an information provider and a connectivity provider. In this scenario, AOL would purchase customized and usage-based priced network services from backbone and access providers. In case of congestion, AOL would have to pay congestion-related charges if the demand is larger than the supplied or purchased capacity. By taking this risk, AOL could sell the network service under a pricing plan, which is more attractive to end-users. For example, the pricing plan could comprise a flat-rated basic service, priced higher than the usage-based charges for the network service at congestion-free times. It is more attractive for end-users since it reduces the risk of highly varying prices.

EXODUS

In the future, Exodus could provide the function of a clearing house (see Section 7.3) since it will put Exodus into the position of providing real end-to-end service. Running this function, Exodus could split up revenues from information provider according to the connectivity service provider involved and the quality delivered. This kind of charging would give an incentive for connectivity providers to provide quality service. Deploying the function of a clearing house, Exodus could provide quality of service even on parts of the Internet, which they do not own.

8.3 Demonstration of M3I Generic Pricing Mechanisms

In order to demonstrate the applicability and use of M3I's new concepts and technology, a number of scenarios will be implemented to give some examples of how the introduced roles and technology could be used by the ISPs in order to built their own charging policy forming various business models.

Connectivity providers in general (data centre, access and backbone) could offer dynamically priced services to their customers and the risk broker could be incorporated as a role in any one of these stakeholders or it could be a separate stakeholder himself. For example an access provider connected to a backbone provider that uses congestion pricing could incorporate the risk broker role in its business model in order to provide to the end-users static contracts (absorbing the risk of varying prices himself). The same role could be a part of a backbone provider who is connected to another backbone provider, etc.

The GSP scenarios will demonstrate how these stakeholders could take advantage of the M3I technology without sacrificing the desirable predictability of charges for the end-users.

If no stakeholder in the Internet value chain incorporates the role of the risk broker, his functionality could be replaced by the dynamic price handler at the edge of the network - at the end-user domain - (DPH/ECN scenario) or by the user himself (User-direct scenario).

Furthermore, the DPH/ECN scenario will demonstrate how an information provider could incorporate the DPH role in order to take responsibility for the varying network prices and offer to his customers a bundled service. Doing so will give him the possibility to offer his services in various qualities (at a different price) becoming more competitive.

9 References

[1] Lakelin, P., "ISP in Western Europe: Dynamics of an Evolving Market", ISP Business, 1999, http://www.isp-planet.com/business/lakelin-study-a.html

[2] Durlacher Research, "Application Service Providers", Special Report, July 1999, http://www.durlacher.com

[3] Greenstein, S., "Understanding the Evolving Structure of Commercial Internet Markets" written for "Understanding the Digital Economy: Data, Tools and Research" Washington DC, 1999, http://skew2.kellogg.nwu.edu/~greenste/research.html

[4] Gibbens, R., Kelly, F., "Resource pricing and the evolution of congestion control", Automatica 35 1999, 1969-1985

[5] R. Gibbens, F. P. Kelly, "Distributed connection acceptance control for a connectionless network", Proc.16th International Teletraffic Congress, Edinburgh, Elsevier, June 1999, 941-952.

[6] Pouloudi A, Papazafeiropoulou A, Poulymenakou A "Use of stakeholder analysis for electronic commerce applications in the public sector: different development scenarios", ESCIS, 1999

[7] Kim C, Mauborgne R, "Value Innovation: The strategic logic of high growth", Harvard Business Review, 1997

[8] Malone T, Yates J, Benjamin R, "Electronic Markets and Electronic Hierarchies", Communications of the ACM, June 1987 vol 30, p484-497

[9] Dutta S, Manzoni J, "Process Re-engineering, Organizational Change and Performance Improvement", Mc-Graw Hill, 1999

[10] Scott – Morton M. "The Co-operations of the 1990's: Information Technology and Organizational Transformation", Oxford Press, 1991

[11] Laffont J, Tirole J, "Competition in Telecommunications", The MIT Press, Cambridge, 2000

[12] ITU-T Recommendation E.801: Framework for service quality agreement, 10/96

[13] Caine A., Negotiating An Effective Service Level Agreement, June 1997, Gilbert&Tobin, http://www.gtlaw.com.au

[14] Gray J., Negotiating An Effective Service Level Agreement – II, March 2000, Gilbert&Tobin

[15] UUNet SLA, http://www.uu.net/lang.en/customers/sla/terms

[16] UK Education and Research Network SLA; http://www.jisc-tau.ac.uk/sla.html

[17] EURESCOM P806-GI Deliverable 1: EQoS – A common framework for QoS/NP in a multi-provider environment, Heidelberg, September 1999 http://www.eurescom.de/Public/Publications/Projectresults/P800-series/806d1.htm

[18] Braden R. et al, "Integrated Services in the Internet Architecture: an Overview", IETF RFC 1633, June 1994

[19] ETSI ETR 003, Network Aspects (NA); General aspects of Quality of Service (QoS) and Network Performance (NP)

[20] S. Blake, D. Black, M. Carlson, E. Davies, Z. Wang, W. Weiss, "An Architecture for Differentiated Services" , RFC 2475, Dec. 1998

[21] Network management Forum: Performance Reporting Definitions, April 1997, NMF 701

[22] ITU-T Recommendation I.350: General Aspects of Quality of Service and Network Performance in Digital Networks, including ISDN. 03/93.

[23] Network Management Forum 504: SP to SP Interface business Agreement, issue 1.0, 9/97.

[24] TEQUILA IST project site: http://www.ist-tequila.com

[25] Goderis D., et al. Service Level Specification Semantics, Parameters and negotiation requirements. Internet Draft, draft-tequila-diffserv-sls-00.txt, July 2000

[26] T'Joens Y. et al, Service Level Specification and Usage Framework, Internet Draft, draft-manyfolks-sls-framework-00.txt, April 2000

[27] Rajan R. et al., AT&T's SLS, Internet draft, draft-sls-somefolks-00.txt, November 2000

[28] Slasano S. et al, Definition and usage of SLSs in the AQUILA consortium, Internet Draft, draft-salsano-aquila-sls-00.txt, November 2000

[29] UMTS Forum, "Shaping the Mobile multimedia Future-An extended Vision from the UMTS Forum, Report no. 10" September 2000

[30] Briscoe, B., The Direction of Value Flow in Multi-service Connectionless Networks, Second International Conference on Telecommunications and Electronic Commerce (ICTEC'99), Nashville, TN, US, (6-8 Oct 1999) (18pp (inc 4pp appendices), 7 figs, 20 refs)

[31] M3I Consortium, Deliverable 1 Requirements Specifications Reference Model, July 2000, http://www.m3i.org

[32] Bouch, A., Sasse, M.A. (1999). "It ain't what you charge, it's the way that you do it: A user perspective of network QoS and pricing". In Proceedings of IM'99.

[33] Edell, R., Varaiya, P. (1999). "Providing internet access: What we learn from INDEX". Paper presented at Infocom '99.

[34] R. Gibbens, F. Kelly, (1999), "Resource pricing and the evolution of congestion control", Automatica 35, 1969-1985

[35] Huber, J, Weiler, D and Brand, H. (2000), "Mobile Radio Advances in Europe: UMTS, the Mobile Multimedia Vision for IMT-2000: A Focus on Standardisation", IEEE Communication Magazine Sept. 2000