Pre-study on Customer Care, Accounting, Charging, Billing, and Pricing

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1. Michael Bünter, Computer Engineering and Networks Laboratory (TIK), ETH Zürich, Switzerland, provided some written input on ATM-related aspects. Hans Einsiedler, Institute for Computer Communications and Applications (ICA), EPF Lausanne, Switzerland, offered written input on technical fairness issues.

Executive Summary

Electronic Commerce platforms offer an opportunity for businesses and challenges for research. As closed markets do require generic transport services only, open Electronic Commerce marketplaces need to deal with the delivery of advanced electronic services due to intense trends to value added information services. After having deployed proprietary platforms, solutions with global access networks commenced due to the commercialization of the Internet. However, today the global electronic marketplace based on integrated services networks is envisioned, since the essential world-wide interconnection of residential customers and businesses at the same time can be provided by the integrated services Internet.

It has been observed within this pre-study that closed platforms show a matured state with proprietary products, applications, and tools, sometimes offering semi-open interfaces allowing for the integration with additional system components, but lacking open semantics. However, regionally and logically restricted approaches, such as Swiss Videotex, German Btx, or French Minitel, are going to be replaced by open Electronic Commerce platforms. These open and public solutions start to flourish, mainly driven by the globally accessible Internet. Profound research to obtain an efficient and service integrated platform supporting advanced services is still required.

The information society bears a stringent need for advanced communication services and content. Although solutions for methods of charging and accounting single service class networks, such as the telephone network or Virtual Private Networks, exist and are applied successfully, Integrated Services Networks require a completely different approach. Charging and accounting for integrated services remain unsolved problems at the time being which is due to a huge variety of service characterizations by Quality-of-Service, advanced networking technologies, such as ATM, and a dramatically emerging integrated services Internet. In addition, new telecommunication services impose another degree of complexity to existing billing systems, including the demand to bill for content. This determines the need to integrate concepts for interoperable and standardized billing solutions between providers for inter-operator agreements which may include content and transport services. A particular problem area arises with electronic payments for transport services, determining the clear necessity of pico- or micro-payments. As existing traditional and electronic payment systems are not well suited for this task, solutions have to be researched, including cryptographic protocols for secure transmission of payments. Due to the highly competitive telecommunication service provider market, dynamic pricing schemes for integrated multiservice networks are required as well.

Today, customer care demands for an open, automated, and agent-based electronic market solution, since proprietary, workflow-based, and closed systems already are available. However, standardized customer care interfaces have to be developed and they will allow for the integration of vertical and horizontal business systems supporting customer-related marketing and advertisement. More important, the provision of overall, successful, and open Electronic Commerce requires clearly defined legal frameworks, financially profound taxation acts, and market-oriented pricing schemes.

Once the prerequisites of Electronic Commerce, including organizational obstacles, technical problems on accounting, charging, and billing, and customer-centric customer care systems, have been clarified, solved, and developed, respectively, the success of global Electronic Commerce is in reach. However, it still depends on the customer acceptance and satisfaction of an integrated telecommunication platform enhanced by value-added services and it depends on the prospects of vendors and service providers to sustain long-term profitability enabled by dynamic pricing schemes.

Based on this pre-study's results the following research areas are recommended for in depth investigations:

- Accounting and charging protocols
- Convergence and integration of telecommunication services
- Incentive-compatible pricing models for Integrated Services Networks
- An environment for trading communities
- Open billing systems

Furthermore, additional demonstrators and user trials are suggested to foster technology transfer between academia and telecommunications industry in collaboration with SMEs and start-up companies:

- New media and information services
- Enhanced and integrated telecommunication services
- A self-sustainable high-performance network for Swiss research

Preface

This pre-study has been appointed by the Swiss National Science Foundation (Schweizerischer Nationalfonds) within the Swiss Priority Program (SPP) for Information and Communication Structures (Schwerpunktprogramm Information und Kommunikation) on December 22, 1997 to the Competence Center for Information and Communication (CCIC) of the Swiss Federal Institute of Technology Zürich (ETH Zürich) and has been performed by the Computer Engineering and Networks Laboratory (TIK). The pre-study is part of the process to set up a Networked Competence Center for Applied Research and Development in Electronic Commerce. The following tasks have been accomplished within the area of "Customer Care, Accounting, Charging, Billing, and Pricing":

1. Identification of players and roles in electronic market places to evaluate concerns, challenges, and related work of Electronic Commerce architectures and frameworks with special attention focussed onto customer care, accounting, charging, billing, and pricing.
2. Determination of state of the art for each of the fields identified in the title of this pre-study.
3. Exemplified brief interviews with a number of industry representatives on the technical and project management level, of Small and Medium Enterprises (SME), and of academic personnel.
4. Identification of user and provider requirements for achieving a suitable system in support of Electronic Commerce with respect to customer care, accounting, charging, billing, and pricing.
5. Based on the pre-study, a summary of observations and an exemplary list of hot research topics are given.

Personnel of the TIK invested within the time frame between January 6 and February 19, 1998 in total 40 working days to obtain a detailed view on facts for this pre-study. Many thanks are addressed to Hans-Karl Pfyffer, the SPP-appointed manager for this pre-study and the overall Electronic Commerce project. Furthermore, almost all interview partners[1] offered a basis for excellent discussions and fact findings, however, a strong fear in particular with one SME in the loss of competitive advantage has been observed. Many additional contacts have been established electronically to obtain further detailed information. The authors would like to express their thanks to all supporters and discussion partners.

1. The following groups and people, presented in alphabetical order, have responded in technical terms to brief interviews: Alcatel (Franz Röhmer, Werner Hug), econis ag (Andreas Brun), Hochschule St. Gallen (Katarina Staneovska, Hans-Dieter Zimmermann), Swisscom (Rolf Eberhardt).

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1. Introduction

The field of Electronic Commerce encounters a variety of interactive services which have to be integrated seamlessly within an Electronic Commerce Architecture (ECA). Business opportunities arise in markets, where the development, design, implementation, and operation of electronic systems provide revenues to every participant, such as providers, operators and platform developers. Therefore, a number of distinct characters for Electronic Commerce have been identified [ScSh97]. They encompass at least, a network, a community-organizer, an agency, and a platform provider. However, current barriers for the takeoff of Electronic Commerce are threefold, specifically (1) ease of use, (2) universal access to necessary hardware, and (3) privacy [Chau97] are not widely provided. A more detailed view onto these issues identifies that technical requirements in terms of platforms, communication protocols, and hardware are not isolated. Business processes and economic theory are strongly involved in the design, definition, and implementation of profitable solutions for ECAs.

Different models and architectures for Electronic Commerce have been proposed. For example, [ScLi97] describe a model for electronic market places using different abstractions (business, transaction, service, and infrastructure views) along a transactional time abscissa. Customer-care, accounting, charging, billing, and pricing in telecommunication services make up an important of such an ECA. A summary of influential factors is illustrated in Figure 1. Components that shape this particular picture of Electronic Commerce include user requirements, products, services, and providers with their associated telecommunications infrastructure which also contains accounting/billing systems. Customer care is providing an interface between these two parties. In the background, business models and more general economic models for services and products as well as legal and policy issues play an important role.

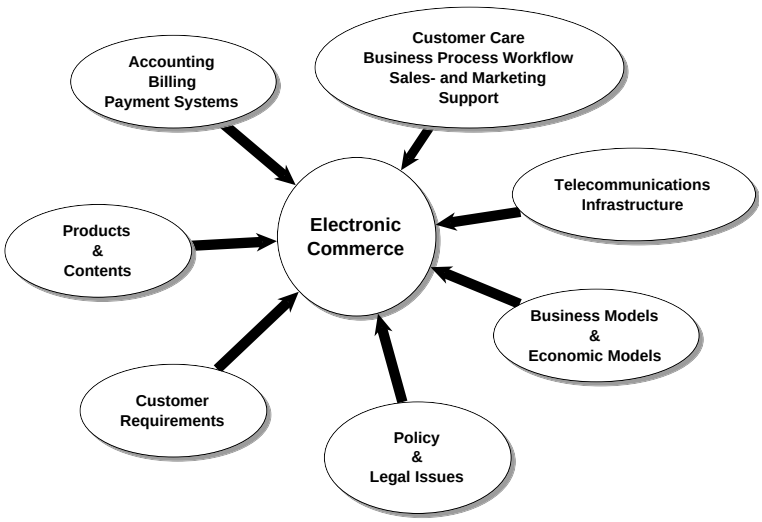

Figure 1: Components in Electronic Commerce

Concerning this pre-study and the Electronic Commerce project of the Swiss National Foundation, Electronic Commerce involves the following disassembled fields: (1) Security, (2) Customer care, accounting, charging, billing, and pricing, and (3) Business-to-business systems. Obviously, besides the main focus of this pre-study on customer care, accounting, charging, billing, and pricing, important features, effects, and technical interfaces to the other two areas are identified briefly. In addition, a pin-pointing discussion of the Electronic Commerce environment is presented with respect to Electronic Commerce architectures, challenges, concerns, taxation and legal issues, and a suitable abstraction level.

1.1 Outline of this Document

This pre-study is structured as follows. The environment of customer care, charging, accounting, billing, and pricing for an Electronic Commerce platform is discussed in Section 2 in terms of challenges and concerns, services, taxation and legal issues, related work and abstractions of an ECA, and relations to the two other pre-studies.

This pre-study details as the main part in Section 3 all relevant aspects of (1) customer care; (2) accounting and charging; (3) billing and payment systems; and (4) pricing and economic models within four subsections. In addition, Section 4 enlists in an exemplified overview projects, standards, and products in these areas. FInal conclusions are drawn and research topics are identified within Section 5.

The bibliography is presented in Section 6. The extensive Appendix A to C consists of a detailed presentation of related research programs, projects, standards, and products including their brief abstracts, points of contact, and additional information. Syntactically, references to the literature are printed like [Haas97] and references to projects, standards and products are given as *[IBM96]* and refer to the tables in the appendices.

2. Environment

An Electronic Commerce scenario involves a number of players, who interoperate, offer and buy goods, provide services for contents, payments, and transport, or simply grant electronic information. As depicted in Figure 2, six groups of distinct players define six discrete roles. It is important to obtain a structured view of these roles and their associated responsibilities and tasks.

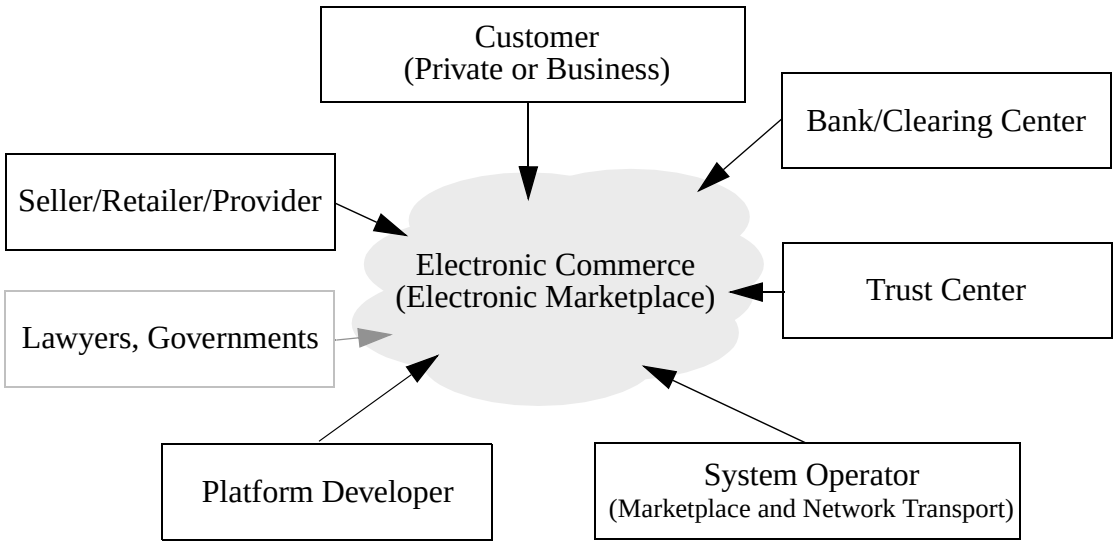

Figure 2: Roles and Players Effecting Electronic Commerce

The *customer* is the user of and the buyer in an electronic marketplace. He may be (1) a private or residential customer or (2) may act on behalf of businesses. The order and utilization of goods – electronic or tangible goods – and services from retailers requires the electronic marketplace to offer a possibility to pay for these goods. Payment involves an interaction with banks, clearing centers, and trust centers. In addition, an implicit or explicit contract is required between customer and retailer to establish legal issues, such as liability and guarantees.

The *retailer*, *seller*, or *provider* offers goods – electronic or tangible goods – and services. This role determines the content and goods which are provided in an electronic marketplace. Offers are based on a pricing model. Pricing models determine the final price based on (1) the *content* and (2) *transport service* costs (networking via electronic delivery or physical delivery). Furthermore, extras, such as electronic marketing cost, or hard- and software cost for the electronic marketplace may be added. Contracts between the retailer and the system operator are necessary to establish administrative, organizational, and legal viewpoints of the relation retailer and electronic marketplace.

The *platform developer* shapes an appropriate electronic marketplace based on hard- and software components which are suitable for a given requirements profile. This may include Internet-based marketplaces, telecommunication services, or closed markets. Obviously, payment systems, smart cards, financial services, transport services, marketing and advertisement efforts, and notary services amongst others have to be integrated homogeneously within an efficient platform for electronic marketplaces. Therefore, technological, economic, and business process-oriented tasks have to be integrated homogeneously.

The *system operator* is distinguished by two different roles: (1) the electronic marketplace operator and (2) the network operator (transport). While the former is responsible for supplying appropriate hardware and software to retailers and customers before utilizing the electronic infrastructure, the latter provides the heart of electronic on-line transactions, the transport service for trading processes, payments, and electronic goods distribution.

Banks and *clearing centers* form the main players in terms of providing financial services for customers and retailers. They determine rules for issuing electronic money or for propagating different payment systems in addition to traditional functionality. Banks are an important prerequisite for electronic market places due to the exchange of money in the customer retailer relationship, where partners may be unknown to each other.

Trust centers deal with the task of key management (issuing, storing, certifying, and revoking) for customers and businesses, in turn allowing for the authenticated transfer of messages between customers and retailers for, *e.g.*, contracts, electronic goods, or payments. Secure and possibly governmentally organized centers issue certificates for session keys, signatures, or electronic money.

Externally, *lawyers*, *governmental offices* (*e.g.*, trade department, treasury department, or data privacy department), and parliaments play an important role in outlining and defining legal acts, regulations, and laws for an electronic marketplace which need to comply with traditional legislative concepts and social norms.

2.1 Challenges and Concerns

Electronic Commerce requires an international platform to perform worldwide, electronic trading. Besides others, important obstacles for the practical and broad usage of electronic trading systems lay in the employment of an electronic payment system, a suitable and open customer care interface between business and private customers, methods to charge and account for content and transport services in a variety of underlying networks, and appropriate platform-wide billing systems or appropriate open billing tools and interfaces.

The technical infrastructure for electronic commerce requires to offer connectivity between customers and sellers in terms of multiple connections, their specified performance, and their

clearly defined costs. This allows for the setup of a suitable and profitable marketplace. Whether purely Internet-based solutions, ATM-based (Asynchronous Transfer Mode) approaches, closed markets, or highly interconnected Intranets offer and determine the Electronic Commerce platform of the future, the above mentioned obstacles remain quite similar, however, some technical solutions or closed market scenarios are available as presented within this pre-study.

Electronic Commerce in general offers a challenge for the near and long-term future of new dimensions in trading, of opportunities in new markets, and different methods to generate revenue. However, a number of questions and technology decisions have to be taken in advance to facilitate and support the novel concept, if and only if Electronic Commerce becomes politically and personally accepted within a society. These questions encompass the following ones, but are not limited to them:

- How many business phases and processes are required to be supported electronically?
- What is the underlying communication technology to be used?
- Are fair and supervisory methods to account, charge, and bill available?
- How to design methods for a transparent pricing of transport services and content?
- Are integrated products available that enable the private or residential customer to access, use, pay for, and enjoy an Electronic Commerce platform?
- Is the Electronic Commerce approach a valuable proposition for the seller (increased revenue) and the buyer (lower cost, convenience) at the same time?
- How shall trust be designed for customer care products in business-to-business and business-to-customer scenarios?
- What are the organizational measures to achieve a vertical integration of management policies in customer care?
- What are the sociological influences and effects?

These questions may be answered only, if a very close integrated solution approach is followed, including technology experts, economic experts, management experts, political economic experts (Volkswirtschaftsexperten), and law experts.

As an example, critical enabling technologies for Internet Electronic Commerce, such as hardware and software in the public key infrastructure, *e.g.*, smart cards, must evolve [Mulq97]. Interesting to note is that Electronic Commerce tends to be measured by Electronic Data Interchange (EDI) [ANSI] software sales. This is based on the fact that EDI, utilized as the main basis for Electronic Commerce on the Internet, “is extraordinarily secure and reliable” [Mulq97], “even though it has been seen as rigid, proprietary, and expensive”.

An Electronic Commerce platform does not challenge the technical issue only as quoted above. Legal issues, regulation, and taxation are important aspects to be considered as well. Current acts and laws do not back up electronic trading processes completely. Questions of world-wide law include, *e.g.*, copyright issues, responsibilities for content, liability of providers, validity of electronic trade agreements, secure signatures, and contracts.

2.2 Services Affected by Accounting, Charging, Billing, and Pricing Issues

Telecommunication services form the basis for Electronic Commerce. In the traditional notion and for future services to be provided in an electronic market place these services are influ-

enced considerably by accounting, charging, billing, and pricing structures. Taking the opposite view, from the services themselves towards the infrastructure, accounting, charging, billing, and pricing are also affected by these evolving services. An example for the latter case is the marketing effort of telecommunication service providers to bundle services and to increase their attractiveness. MCI introduced a program called “Family & Friends” which provides cheaper long distance calls for certain preferred numbers. Of course, this new form of offering simple telephony service requires to change many aspects of the accounting and billing system. In fact, it took some competitors years to implement a similar system.

The following list gives an exemplified overview of what telecommunication services are considered to be important in the context of accounting, charging, billing, and pricing:

- Telephony and Fax
- Mobile Telephony
- Messaging, Paging
- Electronic Mail
- News Services, Electronic Newspapers, Electronic Magazines
- Directory Services
- Notary Services
- Voice Mail
- Digital Video (live, from databases)
- Digital Audio (radio broadcasts, music databases)
- Multimedia Conferencing Services
- Electronic Transactions
- Virtual Private Networks
- Intranets

Pricing of these services is determined by two components: *transport* and *content* related prices. For some services, content pricing is omitted since the customer is responsible for the data to be transmitted, *e.g.*, phone or fax. Consumer oriented services which transport copyrighted content, however, do need to be charged for content material too, *e.g.*, video databases or digital libraries. Other services which need negligible bandwidth, might want to charge *only* for content (cf. Section 3.4).

2.3 Taxation, Legal, Accounting, Charging, and Billing Issues

Besides important accounting, charging, and billing tasks many *taxation* and *legal issues* play a significant role within the Electronic Commerce area in general. The tax system imposed on the exchange of electronic goods varies in different European and American countries. For instance, “Value-added Tax (VAT) already applies to electronic trade in goods and services” [Hayw97], which has been decided to be collected for all on-line services within the European Union (EU), regardless whether customers are based in the EU or not. Therefore, the new form of electronic business does not have to be more difficult compared to traditional commerce. Specifically, a tax imposed on “the data bits that travel over networks” [Hayw97], the proposed “Bit Tax” of some European countries, has been rejected by the European Commission [NZZ98]. In the U.S.A. a forum is put forward to define a uniform approach for taxation of Electronic Commerce as approached by the OECD [OECD98].

Legal issues within the area of networking and Electronic Commerce encounters the regulated or deregulated provision of electronic services, open markets, and communication services. A special case has been reported [Macl97], where a Californian company resold toll-free services from AT&T to Internet Service Providers. Reselling of bandwidth, services, and electronic goods requires a detailed investigation on legal and technical aspects, since Internet Service Providers purposely resell as part of their core business at least bandwidth, often enhanced by some value-added services, such as e-mail, paging, or information brokerage. In addition, *e.g.*, telecommunication tariffs as set up between local and long-distance carriers for exchanging their traffic (inter-operator agreements) undergo a dramatic change due to upcoming services as well as deregulation of the telecommunication sector. The fear of revenue and traffic loss in traditional telecommunication industries requires worldwide regulators to decide if, *e.g.*, Internet traffic uses trunks for free or if it has to based on a tariff structure [Tadj97]. Finally, regulations on service cancellation have been accepted by the EU [Herb97].

Accounting and charging methods apply to three completely different domains. (1) Content-based methods deal with appropriate approaches to identify the value of content and information, named as non-tangible goods. (2) Methods to account and charge transport services, however, are utilized for traditional telephone systems offering a fixed quality for this telecommunication service. Modern services, such as high-speed Asynchronous Transfer Mode (ATM) transport services or Internet services, still require practical and low overhead solutions for accounting and charging [Giri97]. In particular, since these costs for transport or in general telecommunication services can not be neglected in an Electronic Commerce scenario and are currently to high [CoZe98], suitable, efficient, and flexible methods to account and charge for are demanded. Additionally, as the shift to charging for Internet Service Providers (ISP) did not destroy the Internet and a highly competitive market with many infrastructure providers exist, “it may, indeed, be a desirable step towards [the Internet’s] maturity and financial stability” [Tele97]. Finally, (3) accounting and charging methods for the purchase of physical goods are well understood and will not be considered within this pre-study any further.

Various *billing methods* are applied to bill consumed goods and utilized services to customers. These methods may include automated withdrawals from bank accounts omitting the transfer of a paper-based invoice. This is a traditional scheme, determining a form of a payment system. However, the focus on Electronic Commerce extends these traditional schemes due to many electronic aspects involved. On one hand as mentioned above, goods being sold and billed for may be of electronic nature. On the other hand, payments may be made within an electronic system, avoiding the exchange of physical money or any paper slips at all. Today, it does not seem to be clear, how the handling of traditional and electronic systems within one integrated scenario can be organized administratively. The example discussed in [Brau97] shows that a customer-based on-line selection of the preferred billing method, such as direct debit or invoicing, still requires an authorization form which has to be filled-in and returned by surface mail. If this traditional concept of authorization, even for the subscription to on-line services, fails, a service provider will be alleged violating Federal Trade Commission Acts in the U.S.A.

These examples illustrate, that besides the investigation of central technical prerequisites for an open Electronic Commerce platform and market within this pre-study, an additional activity is proposed for future work an Electronic Commerce to identify relevant laws, regulation or deregulation concepts, and taxation for commerce, telecommunications, and customer protection, which have to be adapted to electronic needs. For a detailed explanation of security issues refer to the pre-study on security [Zurf98].

2.4 Existing Electronic Commerce Environments and Their Abstractions

As a variety of proposals for Electronic Commerce reference models or frameworks exist, the following brief outline of most recent work describes main features with respect to this pre-study's focus on customer care, accounting, charging, and billing. Afterwards, the views on players, participants, components, and business processes is proposed in an abstract manner to allow for their clear identification without a specific developer's, designer's, economist's, or lawyer's perspective.

2.4.1 Related Work in Electronic Commerce

A list of components for a reference model of Electronic Commerce has been discussed in [ScLi97]. Electronic markets represent the emergence of traditional markets by incorporating telecommunications and information technology and they show the main characteristic of their independence of space and time. The ubiquitous presence of information on a global scale determines the dominant difference to traditional markets. The following definition is included in [ScLi97]: "Electronic markets implement market places based on telematic tools which support the exchange of goods and services during all business processes (transactions)."

The Open Service Market (OSM) Architecture allows for the emergence of demand/supply processes based on market transactions [MWAs96] as part of a discontinued ACTS (Advanced Communication Technologies and Services) project. Statically typed communication mechanisms included in communication middleware require a standardization of services to be offered within this system. This drawback limits particular electronic markets to pre-defined business processes and market transactions. This problem can be solved, *e.g.*, by generic user access tools (such as Java-based applications) allowing for the remote execution of code, however, a clear association from roles to software components is lacking [MWAs96]. Therefore, OSM bases on middleware an Electronic Commerce support framework, including security, brokerage, desktop environment, and service profiles, which is utilized by various applications.

A strategic framework for developing Electronic Commerce covering structures of Digital Interactions Services (DIS) and their strategic positions is presented in [ScSh97]. DIS defines utilities for facilitating electronic markets. Business opportunities arise due to the development, integration, and operation of electronic markets. Since none of todays industries is able to provide a complete system, a convergence of interests is fruitful for Electronic Commerce to optimize resource usage, interface efficiency, and technology interoperability.

The Support Environment for Electronic Commerce SECCO is based on distributed object technology [TMOT97]. Modular building blocks follow CORBA (Common Object Request Broker Architecture) and TINA (Telecommunications Information Networking Architecture) specifications. These components encompass a layered approach with networking infrastructure, middleware (*e.g.*, including security, stream support, trader, notification services), business object facilities and common business objects, Electronic Commerce application facilities (such as session management, subscription and accounting service, and federation), and Electronic Commerce applications (such as multimedia communication services, Web-stores, and trust center). Payment system support and customer care have not been dealt with. However, accounting, charging, and billing, for customers is integrated as an application facility.

The Eco System defines an Internet commerce architecture as a framework of frameworks to bridge the gap of conflicting platforms [TCHu97]. It includes four categories of frameworks that need to interoperate: networking services, commerce services, business services, and

Internet-market services. Eco System develops a common business language to provide application features for expressing their messages and objects as in a real business world. Based on a middleware layer, an object-oriented development environment is utilized in addition to an industry roadmap for interoperability constraints.

Table 1: Overview and Focus of Models and Frameworks for Electronic Commerce

Approach[a]	Strategy	Business Processes	Middleware Aspects	Communication Aspects	Customer Care	Accounting, Charging	Billing, Pricing
Reference Model for Electronic Commerce	no	yes	no	no	–	–	–
Open Services Market	no	no	yes	yes	–	–	–
Digital Interactive Services Framework	yes	no	no	no	–	no	–
SECCO	no	yes	yes	yes	–	yes	–
Eco System	(yes)	yes	yes	yes	(yes)	–	–

a. The dash "–" denotes that this focus has not been mentioned within the investigated literature.

A brief comparison of reference models and frameworks is given in Table 1. It shows that the focus of these approaches and their detailed developments are not similar which is visible due to mainly economically-driven or technology-driven developers. Customer Care, accounting, charging, pricing, and billing aspects hardly form a constituent of todays electronic market places and their architectures.

2.4.2 Electronic Commerce Abstractions

Figure 3 extends in an abstract manner the previously introduced components in Electronic Commerce (cf. Figure 1) and separate players and roles effecting Electronic Commerce (cf. Figure 2). Therefore, it depicts the abstract view of participating players within the given Electronic Commerce scenario, particularly focussing at the customer, customer care interfaces, the accounting, and the billing functionality.

Assuming a direct selling market, a variety of services is offered to customers, such as information services, enhanced telecommunication services, financial and clearing services, or traditional telecommunication services. In addition, retailing physical goods is depicted in the far left, however, ending up in physical transport services (delivery). A specifically adopted customer care interface and functionality is required to offer these services in an appropriate manner. *E.g.*, traditional telecommunication services are offered by a customer network management-based customer care interface, including for instance TMN (Telecommunication Management Network) compatible approaches, and financial services provide the basis for processing payments, checks, or credit cards.

In contrast, value added service resellers buy single services themselves and offer wholesale services to customers or other resellers. These third parties may be included in the process between the original service provider and the customer as often as revenue is still available and a profitable market emerges. As this indirectly selling market comprises different customer

care requirements, a wholesale customer care interface is offered. This may be different for resellers dealing with end-customers retail, since a recursive structure with multiple resellers may exist.

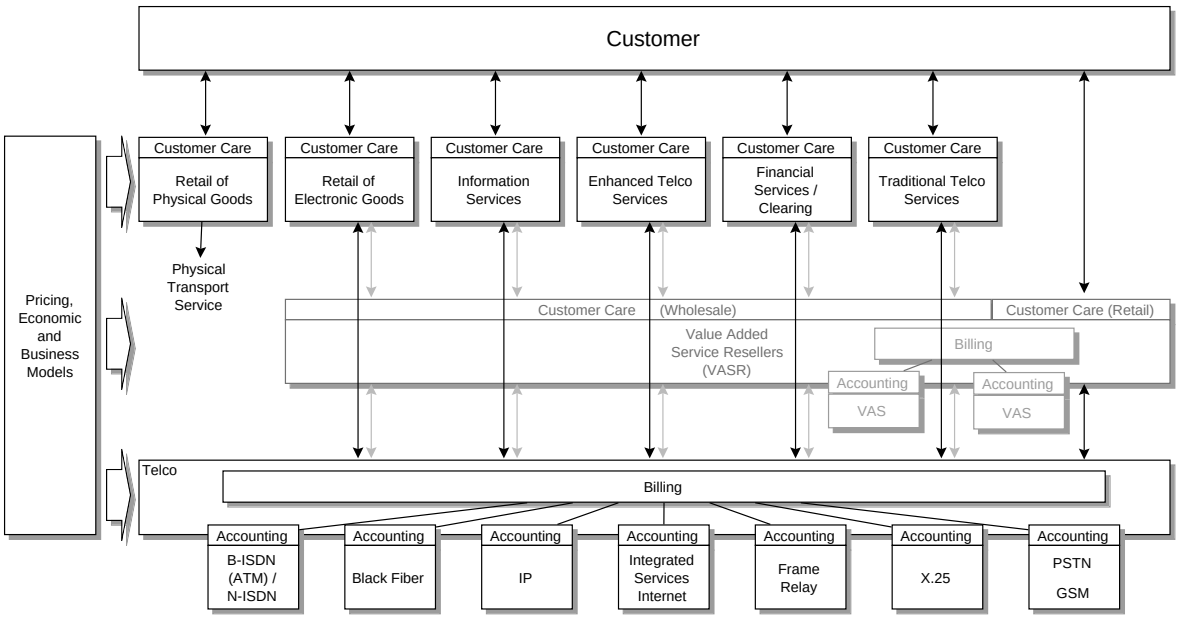

Figure 3: Classview of Players in the Electronic Commerce

Basic telecommunication services are illustrated at the bottom of Figure 3. Depending on the technology suitable for retailers or resellers, ATM-based B-ISDN (Broadband-Integrated Services Digital Network), N-ISDN (Narrowband-Integrated Services Digital Network), IP (Internet Protocol), Integrated Services Internet, Frame Relay, X.25, or PSTN (Public Switched Telephone Network) and GSM (Global System for Mobile Communications) services are applied. These services need to be accounted for, which is particularly different for each of these technologies. Counting ATM cells, measuring call durations, or determining the usage of an integrated Internet service heavily utilizes distinct methods, such as byte counters, timer, or traffic monitors, and requires the development for efficient hard- and software components for ATM switches, IP router, or interworking units in general. These accounting informations are charged for according to pricing, economic, and business models as depicted at the left, transforming technical resource consumption and usage information into monetary charging records. Finally, these charging records are fed into a billing system, which is similar for all services within a given telecommunication provider. However, different providers may apply different billing systems, as resellers do to bill their value added services. It has to be mentioned that peering agreements between separate telecommunication service providers and resellers may be used to overcome the need to integrate or interface legacy billing systems, by administratively involving financial and clearing services on a peer-to-peer basis. Of course, value added services require a special accounting infrastructure. Again, charging for resellers depends on the same set of pricing, economic, or business models.

An exemplifying view is presented in Figure 4. It illustrates an example, where three customer types (customer at home, sales business customer, and distributor business customer) utilize services from two different value added service resellers (VASR). A specialized customer care interface provides appropriate pre- and after-sales support, separately for VASR, *e.g.*, a paging or roaming services, and an Internet Service Provider (ISP), *e.g.*, an e-mail or news service. In addition, these VASR are determined by separate economic models which depend on the offering strategies of reseller in terms of time and service pricing. Every VASR and ISP may select

a single or multiple private pricing models, to determine suitable pricing schemes for offered services, such that these models may follow a revenue maximization strategy or may start to gain a new share of the VASR or ISP market.

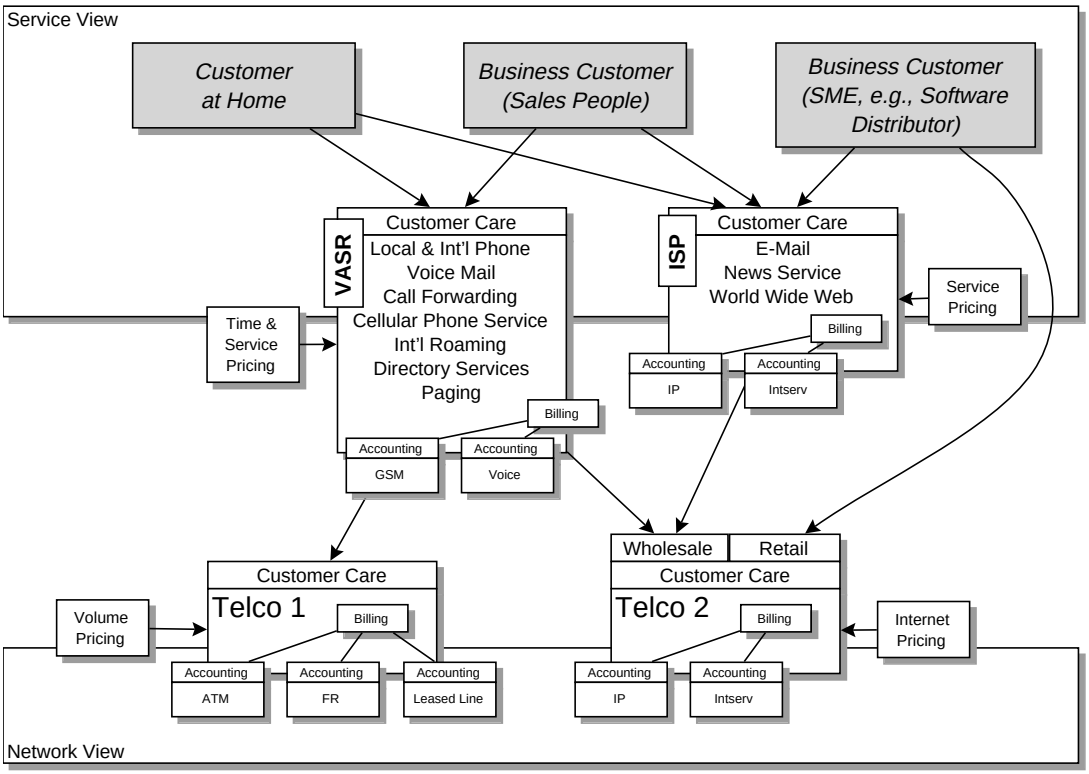

Figure 4: Objectview of Players in the Electronic Commerce

Value added services reseller VASR and ISP employ two telecommunication service providers (Telco 1 and Telco 2). While Telco 1 provides a three basic telecommunication services, *e.g.*, ATM, Frame Relay, and a Black Fiber leased line, Telco 2 offers a wholesale and a retail interface for two basic telecommunication services, *e.g.*, IP and intserv (Integrated Services Internet). With each of these telcos an appropriate customer care interface and a billing system has to be available in addition to the designated accounting methods. Pricing models control the tariffing of governmental restricted services, such as within Telco 1 based on volume pricing, or determine a free market price, *e.g.*, offered by Telco 2 and its Internet pricing. Due to the fact that customers endure either VASRs or ISPs or even Telcos (such as the distributor business customer) on a pure service view, the customer care interface is essential to offer services. In addition, these interfaces vary according to a wholesale offer or a simple retail offer as depicted for Telco 2.

2.4.3 Example Businesses and Electronic Malls

The variety of goods and services sold in an electronic market, whether it is open or closed, is quite huge. Even though numbers on the revenue obtained are difficult to get for all business sectors, some examples on the traded goods are available. The following list exemplifies some approaches only, since it is not task of this pre-study to survey these activities, but for a detailed discussion on business-to-business systems, refer to the pre-study [Reva98]. An Internet-based stock trading service is reported in [Kane97], since the financial charges per trade are one quarter of a discount broker. Therefore, the cost argument for customers and the revenue argument for retailers is obvious. A clothing company is extending its businesses by Electronic Commerce due to integrating major clothing distributors into the system's back end via

Internet, who in turn define the company as their default supplier. In this case “the seller gets increased income. The buyer gets cost and convenience [Kane97]”. Camera stores, book stores, or computer hard- and software distributors and companies enlarge the potential market sectors. Electronic services include health care, tourist information, the Massachusetts Registry of Motor Vehicles [Gerw97], information-heavy publishing sites, or tele-banking. However, Electronic Commerce does not seem to be suitable for all goods, such as car selling [Albr98]. Internet-based approaches have been investigated in another study [MEMe97].

Integrated shopping, service, trade, and information centers are approaching within the Electronic Commerce area. To obtain experiences the Electronic Mall Bodensee [EMB98] has been established to achieve research, political, and economic targets to reduce information costs, to organize and structure Internet-based offers and commerce within the Bodensee region, and to reduce market transaction costs [Schm97]. A proprietary platform for Internet-based electronic business (e-business) is provided by [IBM98].

2.5 Relations to Other Tasks within the Electronic Commerce Project

As this pre-study forms one of three closely interrelated parts, relations to the two other studies of the Networked Competence Center for Applied Research and Development in Electronic Commerce are identified to determine important commonalities, interceptions, or interfaces.

2.5.1 Security

An Electronic Commerce approach requires security services in a number of different components and layers. As customer care interfaces define interaction schemes between customers and retailers, a pure encryption of exchanged messages sounds reasonable. Whether this encryption shall be located within the customer care interface directly or shall be provided within the transport service of the communications subsystem remains a question of policy. Additional security requirements for customer care requires further study.

Transmission of accounting records requires a secure transport service. Due to potential fraud and technical fault-tolerance aspects charging information determines to be secured data. This may be required to protect the anonymity of a customer during a trade or it becomes necessary to uniquely authenticate charging information for a particular customer or retailer. The authorization of a payment is an inherent security service for electronic payment systems. As shown later, payment amounts vary heavily on the service or content utilized, therefore, pico-payments, micro-payments, or traditional payments demand appropriate and efficient security algorithms. Finally, billing systems include some type of security service which secures the invoicing process, billing data themselves, and participating partners, such as the customer, the retailer, and the clearing center.

Finally, application specific security services may be provided within an Electronic Commerce platform which are heavily dependent on the customer, his expenses, or business requirements in general.

Therefore, the appropriate investigation and clear determination of security requirements and their effectiveness and efficiency for at least the above mentioned short cases is necessary. Additional questions relating to security are addressed in the pre-study “Security” [Zurf98].

2.5.2 Business-to-business Systems

As business-to-business systems and business-to-customer systems determine the two distinct markets in Electronic Commerce, especially the Customer Care interface has to illustrate these differences in a close detail. Due to distinct business and customer requirements different processes to recruit business customers or private customers are obvious. The former ones expect a very personalized offer for goods or services that directly suit business customer's needs. The latter wish about a similar service for all customers, however, it must be offered in a much more efficient manner due to the potential mass market. Marketing experts are requested to design appropriate strategies for electronic advertising and marketing methods.

Within business-to-business systems proprietary billing systems may interoperate at a specifically designed interface. However, even known billing systems follow an add-on approach to existing infrastructures, *e.g.*, financial, book-keeping, or sales systems, with closed interfaces only. Including the private customer in the global Electronic Commerce scenario determines the necessity to define open billing systems and interfaces which allow for the interaction between different content and network providers. This includes the possibility to exchange charging records accordingly.

A proper investigation of commonalities and similar targets for customer care and business-to-business systems need to be studied in closer detail. Additional questions relating to business-to-business systems are addressed in the pre-study "Business-to-business Systems" [Reva98].

2.6 Demonstrators and User Trials

Building demonstrators serves the purpose of proving a researched concept by actually constructing what is claimed. Such prototypes can be further used as technology transfer objects, but they can be used only in rare cases directly in product development. While building demonstrators of reasonable quality is a time consuming task, it is even harder to perform meaningful and effective user trials, because the object to be demonstrated must be of near industrial-strength quality, if realistic results have to be obtained.

User trials and market experiments, if performed, should have a representative number of participants using a service over a significant time. As an example, the market experiment described in [VECh96] started with 160 users over a period of two years. The evaluation of experiments with demonstrators or trial users should be accompanied by independent experts. For example, the ACTS research program provides funding for projects focussing on demonstrators and user trials which offer their services to other, more technically oriented projects.

Finally, it has to be mentioned that user trials should be planned with clear incentives for customers. Usually, the incentive is access to new technology, but this is not always attractive enough to keep up with the motivation. For possible user trials within the domain of charging, accounting, billing and pricing of telecommunications services, interesting price and service advantages could serve as a very motivating incentive for customers. In addition, the customer care aspects need to be supported by a viable and efficient system, such as a call center. However, such a plan would need the contribution of economists to allow for a sound theoretical basis. Some research proposals are included in Subsection 5.2.

3. State-of-the-Art Research

State-of-the-art research is described in the following structure. Firstly, Subsection 3.1 deals with customer care issues. Secondly, Subsection 3.2 discusses accounting and charging. Thirdly, billing issues and payment systems are outlined in Subsection 3.3. And finally, Subsection 3.4 handles pricing.

3.1 Customer Care

Virtually, all marketing strategies consider customer care as a cornerstone of success. In an environment with enforced business competition, price and quality are no longer the only differentiation criterions for a potential customer. He or she cares for the grade of service he or she will receive as a customer. Newly emerging concepts (*e.g.*, Total Customer Care [TCC98] or One-to-One-Marketing [PeRo97]) illustrate this trend. In Electronic Customer Care [ECC97], business enterprises allure new customers by innovative, information technology based services. By doing so, they provide enhanced services or reduce the costs of the different steps in the customer-business relationship.

Customer care:
Customer care determines the processes of attention that a customer receives in the three different parts of his relationship with a business (pre-sales, mid-sales, and after-sales).

Customer care center:
A typical, nowadays customer care center consists of three basic elements: (1) the database technology and the marketing savvy to fill this database with individual customer preference information; (2) the ability to handle intelligently inbound phone calls; and (3) the ability to intelligently make outbound calls.

Call center:
A call center is a place, where calls are received in high volume for the purpose of communicating with customers, vendors, or employees. Typical business processes supported include sales, marketing, customer service, telemarketing, technical support, or other specialized business activity.

Help desk:
A help desk is a special form of a call center offering only a limited number of customer care services. It is a department or organization that technology users can turn to for help with malfunctioning equipment, forgotten passwords, misunderstood user instructions, and other problems prohibiting the use of their equipment. Help desk applications can be either internally focused upon employees and other people within an organization, or externally focused on customers. The internal focus provides improved productivity, system error tracking, and employee satisfaction. External help desk applications can be revenue generating, provide increased customer satisfaction with the product or service, and improved customer loyalty, both affecting future purchasing habits.

Workflow:
A workflow determines the way work moves around in an organization. The automation of standard procedures by imposing a set of sequential rules on the procedure. Each task, when finished, automatically initiates the next logical step in the process until the entire procedure is completed.

Workflow management system:
Workflow management systems implement the electronic management of work processes such as forms processing (for example, insurance policy acceptances) or project management using a computer network and electronic messaging as the foundation. “The system completely manages, defines and executes workflows through the execution of software whose order of execution is driven by a computer representation of the workflow logic” [WfMC95].

3.1.1 Customer-business Relationship

New customer care concepts concentrate on three parts of the customer-business relationship.

Firstly, the potential customer’s attention must be attracted by special “shepherding”. Different marketing strategies are employed [Kamb97]. By using customer preference profiles, providers, sellers, and retailers provide information on specific products to a selected group or individuals. Actual Business-to-business transactions exploit this information. However, some sophisticated Internet shops like Amazon.com [Ama97] use customer profiles for providing users with targeted e-mail notifications on new products. Software agents, e.g., Firefly [Fire97], represent another marketing strategy facility. Such agents group user preferences based on their similarities. Companies may use this information to suggest buying opportunities to specific customers. Broadcasting facilities allow different enterprises to offer bids fitted for the customer’s desired product requirements. For example, BidnAsk [Bidn98] accepts postings for computer related equipment from potential customers and forwards bids from vendors to the related questioner. Currently, commerce becomes more information intensive. Companies use more and more information technology to deal with the growing information and to better match products to customer’s tastes so as to enhance the service relationship. The targeted marketing strategies towards old customers create a learning relationship with them and are generally believed less costly than acquiring new customers [Kamb97].

Secondly, the customer must be cared for during the sales transaction. Besides providing him optimal product information, several value-added services are offered to him. Virtual bookstores have the possibility to purchase out-of-print books due to their alliances with second-hand book shops. Trust is an important part of the customer-business relationship. If the customer does not trust the provided security mechanisms of the virtual enterprise, he will not buy the product. A number of trust enhancements have been proposed [SWRa97]. These technologies help to increase the level of confidence that people have in Electronic Commerce.

Thirdly, the traditional after sales support experiences an information technology-based enhancement. Typically, customers contact a call center to troubleshoot problems or to get additional information. An early definition [Luce98] describes a call center as a place of doing business by phone that combined a centralized database with an Automatic Call Distribution system (ACD). But nowadays call centers are more than that. They integrate automation and telephony into businesses processes to both optimize business processes and provide better service to customers. Typical business processes supported include sales, marketing, customer service, telemarketing, technical support or other specialized business activity.

As a result of deregulation and the subsequent advent of new carriers, the telecommunications’ marketplace has become an arena for fierce competition. Providers with flexible operational support systems have a distinct competitive advantage by being able to introduce rapidly product bundles combining multiple services as well as cross-product discounts and promotions. The carrier’s ability to provide superior customer service plays an important role in increased customer loyalty and retention. As a result, customer care is the key to success [Amdo97].

3.1.2 Traditional Services

Typical tasks include answering phone calls or e-mail messages, troubleshooting and resolving technical or handling issues with the customer. This task requests need to be entered in a call tracking system. So a workflow process is started for coordinating the different tasks of the problem. The former tasks are typically denoted as front desk applications. The underlying workflow management system determines the back office part of the system. However, nowadays customer care solutions include both elements in one system.

The present technical infrastructure consists of one out of three types of devices which handle incoming calls [Luce97]. The least expensive is the automatic call sequencer which is traditionally used with key systems. It differs from Uniform Call Distributors (UCD) and automatic call distributors (ACD) in that it has no internal switching mechanism and does not affect the call in any way. It simply recommends which call should be picked up and keeps statistical information on the progress of calls. A more expensive type of device is the UCD. An automatic call sequencer was designed to put some order to the incoming calls for a busy attendant or a receptionist. It is commonly found on a key system. In other words, it is designed for just one person answering a lot of calls. Call center people quickly figured out how to use this function for simple and small inbound applications. ACD systems incorporate both functional and informational advantages for telemarketing center managers, such as automatic and equitable distribution of incoming calls, and queuing of calls. They also provide real time management information to determine the operational efficiency and effectiveness, and the number of specialists and network service lines necessary for the call center to achieve the temporal and cost related objectives. More sophisticated UCDs and ACDs are actually designed for multiple agent inbound queuing, and therefore, have more features.

The above described ACD systems have recently undergone enhancements which have made them a powerful tool. These include vectoring (a simple programming language which specifies exactly how calls are handled when they arrive), expert agent selection, interactive voice response, administration, and the gathering of management information through call monitoring software *[Smartphone]*.

Benefits include greater customer satisfaction, loyalty, reduced staff costs, and hence greater profitability. The flexible configurability of all these elements allows organizations to go all the way to assembling the ultimate system, creating a CTI-enabled (Computer-Telephone Integration) workflow which can stimulate the whole gamut of business processes, not just in the call center. Two of the most prevalent features of CTI-equipped call centers are screen pops and voice-data transfers. The ACD is linked to the company’s customer database and routes the call to an available agent along with the information about the customer [MCI97]. So today's call center switch is a highly sophisticated and integrated business tool capable of being used as a central driving mechanism.

3.1.3 Advanced Services

Besides the traditional communication services (e.g. telephone, fax, e-mail), more advanced, multimedia communication tools can be used. By allowing Internet access into the business' call center, the same level of support is provided to an on-line customer as face-to-face or telephone customers receive. By using desktop audio-video conferencing tools, whiteboards, file and application sharing, the new generation of call centers tightly integrates the Internet market with existing call center management technology. The customer is given the possibility to access anywhere and anytime business-critical customer applications and transactions with live

agent support. The Virtual Software House *[NOLC]* is a sample project of such a use of multimedia services.

3.1.4 Applications and Tools

In this paragraph, several of the most popular and commercial solutions to the different aspects of customer care are presented.

Lotus Domino *[Lotus]* acts as a connector linking users to all various parts of an enterprises Internet- or intranet-based processes, *e.g.*, management systems, internal workflows, databases, applications. It is claimed that Lotus Domino is not just a solution package, but also an integration framework enabling secure, interactive business interactions for the Internet and corporate intranets. In the customer care environment, it is used as back office framework.

SAP Telecommunications *[SAP]* is a strategic business infrastructure, supporting telecommunications customer business processes and telco industry-specific needs. It consists of three basic components which can be complemented by additional services as network management or billing. The enterprise management component allows regulated and non-regulated business planning and data warehousing. The second component, business support, includes marketing and product planning, product development, human resources, treasury and material management modules. The core processes compose the third component. Whether generated internally or by a customer request, a complete work order life cycle can be tracked and managed by SAP Telecommunications. Included are quotes, cost estimates, tasks, capacity planning, commitments, history, and analysis. Service delivery, invoicing and receivable are completely supported in the core processes' component. SAP has been providing enterprise business solutions for telcos for the last ten years. Their customers range in size from very large enterprises to mid-sized and smaller companies.

Internet Call Center *[Lucent ICC]* is one of the new types of call centers linked to the Internet. Besides using the traditional telephone call based support, on-line users can communicate with the business to comment on products and services or to signal their need for more information. Customers' satisfaction is increased by providing quick, accurate information access. The Internet Call Center has the ability to deliver voice and data over a single regular phone line to the customer. So the customer must not disconnect the Web session to free his line and wait for a callback form an agent. The agent has enhanced possibilities to help the customer by leading him on a tour of Web pages to the requested solution or information.

LHS's Intelligent Call Center (ICC) *[ICC/BSCS]* consists of a flexible applications platform combining intelligent call handling with customer-based applications. The ICC applications consist of a series of voice/data modules that can be integrated to best suit user requirements. They are enhanced call center applications ready for customization and CTI. Large numbers of simultaneously incoming calls can be handled and efficiently distributed to appropriate agents. The network component connects several geographically separate telecommunications locations into one uniform network. It optimizes a large number of calls, rerouting them to available locations rather than losing them. An assistance to agents with external and internal "dialing" is provided through the use of an electronic phone book. Telephone numbers of frequently called customers are remembered. This avoids customers having to identify themselves repeatedly.

Kenan Systems' Arbor/BP *[Arbor/BP]* includes customer care features among several others (e.g. message processing, invoicing and financial). It provides an account management and

billing customer care GUI (Graphical User Interface) for Customer Service Representatives (CSRs) and an HTML-based (HyperText Markup Language) GUI (iCare) for customer self-care via the Internet. Collections and treatments can be easily performed by collections representatives. The billing activity can be monitored, invoices can be reissued, and credits adjusted.

Econis AG *[Econis]* is specialized in Electronic Commerce solutions for marketing and sales process automation [Brun98]. Econis figures as a system integrator for a variety of customer care products, *e.g.*, *[Clarify]* and *[Calico Technology]*, providing interfaces to *[SAP]*. Clarify is a provider of customer care-centric solutions for the front desk including sales, marketing, customer service, field service, logistics, quality insurance, and help desk applications, relying on a workflow management system. Calico Technology's software acts as a sales expert, guiding customers to the products and configurations that best suit their needs. The package, called Concinity, can be used by mobile sales representatives or used to support a vendor's call center and customer service operation. The software takes a user step by step through available choices that fit his or her particular requirements.

3.2 Accounting and Charging

Emerging networking areas and their support of accounting and charging are discussed in the following paragraphs according to the key technologies of the Internet and ATM. Other networking technologies and the traditional public telephone network are mentioned briefly. Since networking in general provides the requested connectivity for a variety of traditional applications, advanced multimedia systems, Electronic Commerce platforms, marketplaces, and applications, the provision and usage of this connectivity has to be accounted and charged for.

In the beginning the terminology for accounting and charging is determined around existing definitions and descriptions. Even though a common and unique definition did not achieve an accepted consensus today, a computing service center-based and telecommunication system-oriented determination is utilized within the remainder of this pre-study, if not marked otherwise. Various approaches and input to this discussion may be obtained from [ATMF98], [Bell95], [ETSI95], [ETSI97], [FSPl97], and [McBa97].

Accounting:
Accounting determines the collection of information in relation to a customer's service utilization being expressed in resource usage or consumption. The information to be collected is determined by a parameter set included within an accounting record. This record depends on (1) the network infrastructure, which supports the service, *e.g.*, N-ISDN, ATM-based B-ISDN, or Frame Relay, and (2) the service provided. This information is of technical nature, such as duration of a phone call, distance of a high-speed network link utilized, or number of market transactions done, and it will be the basis for charging and billing.

Charging:
Charging determines the process of calculating a price for a given accounting record which determines a particular resource consumption, thus, it defines a functions from technical values into monetary units. The monetary charging information is included within charging records. Prices may be available for particular resources within the accounting record or any suitable combination depending on applications. The fixing of these prices is determined within a pricing scheme (cf. Subsection 3.4). It is assumed that either accounting records or charging records are collected in a hierarchically (centralized or decentralized) organized manner, to determine appropriate user-, application-, system-, or domain-based charges.

A typical scenario encompasses the accounting applied to the number of outgoing data on a special link or on a content included in a file. Therefore, the accounting record contains the duration of a data transfer, the obtained Quality-of-Service (QoS) characteristics (such as bandwidth consumed, delay encountered, and error rates experienced), and additional resource and device usage (such as a video camera). In addition, the content may be indicated by the number of different video clips sent. These accounting records are fed into the charging which happens in this case in an administrative domain of the video clip provider. Finally, the calculated costs are fed into a billing system and sent to the customer.

3.2.1 Public Switched Telephone Network

Telephony is one of the oldest examples for communications which includes accounting, charging, and pricing schemes. Although telephone calls are supported in Public Switched Telephone Networks (PSTN) by connection-oriented services, they serve as an initial comparison to todays connectionless data communication services, such as within the Internet.

The pricing structures of telephony are of primary interest (cf. Paragraph 3.4.2), since most of the technological issues, such as switching equipment (switches of the telecommunication service providers and Private Branch Exchanges (PBX)) or end-systems (the phone), are different compared to data communications. In addition, any bandwidth or delay requirements are not explicitely specified during the call setup, since international telephone standards define a fixed physical channel bandwidth of digital 64 kbit/s or analog 3.1 kHz and a certain maximum end-to-end delay. This amount of bandwidth is reserved, blocked entirely for the caller, and charged for, even if no participant talks. The accounting of PSTN is based on taxation pulses which determine a certain unit of time spent for a particular distance and time-of-day. Charging is performed as recommended within the D-Series of ITU-T (International Telecommunications Union – Telecommunications Standardization Sector) Recommendations [ITU-D.1], *[ITU-T D]*.

In the fast growing segment of mobile phones, accounting, charging, and billing is performed by measuring time units as it is done for the PSTN. This is also reflected in the charging structure (monetary unit per time unit). The technical process of accounting is highly system dependent, *e.g.*, when using GSM or another standard. In addition to connection time and sometimes time-of-day-based accounting and charging, there are two special cases which complicate the accounting process and the pricing structure considerably.

Firstly, mobile phones allow for anonymous use of phones by inserting pre-paid cashcards (using electronic cash, cf. Paragraph 3.3.2). This method introduces new challenges in accounting and also in security issues of on-line payment systems. Secondly, roaming to foreign networks involves the retail tariff and accounting data for the foreign national network. As a result, the calculation of prices and the accounting structure is very complex and not transparent. However, for GSM-based mobile phone networks, this structure will be replaced by an inter-operator tariff system for roaming services which should make accounting and pricing easier [GSM97].

3.2.2 Traditional Best-effort Internet

Traditional Internet transport services are usually charged on a flat-fee basis. Different Internet Access Providers (IAP) may provide service at different price levels in a single geographic region but the service quality is more or less the same (best-effort). Due to the currently used pricing models, neither the seller nor the customer have a direct control over the actual service

they get, *e.g.*, volume, connection time, and quality. However, large corporations, SMEs, or universities have an incentive to control the spending on Internet traffic, and also control the spending for their departments and institutes.

State-of-the-art solutions to support such control measurements base on mechanisms offered by commercially available routers and switches. The most often used approach is based on packet filtering and statistical sampling which gives a coarse picture of the usage of such services within an organization. However, it is difficult to account usage-based traffic for small units or even single users since the granularity of these methods is too coarse and the overhead significant. For volume measurements the IETF rtfm (Real-time Traffic Flow Measurement) working group has proposed standards to meter flows and to distribute this accounting information via SNMP (Simple Network Management Protocol) [RFC 2064]. Some research performed applies dedicated, but standard hardware and open management interfaces to obtain flow-based traffic measurements [LCLo97].

At the edge of IP networks the Remote Authentication Dial-In User Service (RADIUS) serves as a proposed IETF standard to help manage Internet access networks, in particular large modem pools at IAPs [RFC2138]. Since these links are sensitive to security and accounting, a protocol is provided to authenticate dial-in users and negotiate configuration data. RADIUS servers are implemented by most router manufacturers. Accounting data can be collected on a time-, packet-, or octet-basis for a particular service [RFC2139], *[IETF]*.

IAPs use peering agreements amongst themselves to achieve interconnection. These contracts usually are not based on in- and outbound traffic (as telcos do this), they just state the interconnection agreement per se and are supposed to locate revenue neutral points in the network [Clar96]. The advantage is that there is no need for traffic flow measurements at these points. But recently, this scheme led to problems, since larger, especially backbone providers, said they lost money by agreeing to transport packets across their backbones for smaller IAPs [UUNE97].

The traditional Internet pricing model has been critiqued constantly in the past years for its economic draw-backs of not being incentive-compatible [SCEH96], [Clar96], and [GSWh94]. Furthermore, it is inflexible — for example, it does not allow for combined sender/receiver payments — and does not provide the economic signals which are needed for network planning and expansion. But most importantly, the current model is based on the assumption of a best-effort network that provides the same service to all customers. With the emerging enhancements being built into the future Internet, most notably the integrated services architecture [RFC1633], *[IETF]*, it is very likely that technical achievements (reservations, quality of service and real-time traffic support) will fail, because of shortcomings in economic and business models for the network, providers, and customers [FSPl97]. Moreover, it is not known how current pricing models can guarantee fairness in a network offering service discrimination (more issues of Internet pricing structures are discussed in Paragraph 3.4.3). Economic models are also described as a way of providing adaptive congestion control in packet networks [MaVa95].

In the framework of Internet charging it is also necessary to consider mechanisms which allow for observation and control of aggressive flows to enforce fairness. These mechanisms have to be placed, like bandwidth brokers, at points experiencing high congestion. Floyd [FlFa97] mentions three possible approaches for sharing scarce bandwidth amongst best effort flows, and in curtailing abusive flows. Note that they can be complementary and various combinations are possible. (1) Routers are given responsibility to isolate each flow as much as possible

and they regulate each flow's bandwidth. (2) Primary mechanism is still end-to-end congestion control, but additional mechanisms are deployed to restrict the bandwidth of flows which use a disproportionate share of the existing bandwidth at times of congestion. They additionally propose to rely on the drop history in routers to identify and restrict the bandwidth for these flows. (3) The last approach leads back to charging. Appropriate pricing structures fast enough to keep up with the growth of best effort traffic in the Internet and the ability to provision additional bandwidth on the provider side could be mechanisms to control the sharing of the bandwidth. Congestion control is necessary for fair charging, but charging can also be a mechanism to control bandwidth allocation during times of congestion.

3.2.3 Integrated Services Internet

This paragraph discusses state of the art in research in the area of charging and accounting for the Integrated Services Internet model [RFC1633] (sometimes also referred to as the Next Generation Internet). The integrated services architecture is currently adopted by major telecommunications equipment manufacturers [Bay97], [Cisc98] and is expected to be deployed in the next 3 to 6 years in most developed countries. Proposed charging and accounting approaches are divided into three categories:

- Best-effort charging and accounting,
- Flow- or reservation based charging and accounting in integrated services (intserv), and
- Charging and accounting of differentiated services (diffserv).

The integrated services model is based on service class discrimination. New services encompass controlled-load and guaranteed services which are signalled by a newly introduced Resource Reservation Protocol (RSVP) [ZDES93]. Since the general integrated services approach still maintains the traditional best-effort service class it is discussed here with respect to charging and accounting. Accounting for datagrams in a connection-less network imposes a high processing overhead on Internet routers. To measure volumes and account them to address-port pairs was studied in the rtfm working group and practical experience was collected in New Zealand where the only Internet link is a satellite connection and usage based accounting was necessary [Brow94]. The seminal work of Varian and MacKie first mentioned the application of economic pricing models to Internet traffic [MaVa95]. Their first auction-based approach was never implemented and is still considered as too costly. Nevertheless, a recent proposal for an experimental high-speed router based on multiple processors aims at integrating auctions on packet level [Suez98]. Other approaches use hardware to speed up accounting [EMVa95], *[INDEX]*.

With the new integrated services description, it was time to review charging and accounting issues [SCEH96]. With bandwidth reservation and support for QoS new models and architectures for charging and accounting surfaced. The auction-based approach was revisited by MacKie and applied to flows on the integrated services architecture [MacK97], [WMJa97], *[MARX]*. MacKie gives a solution for network optimization based on economic principles (Generalized Vickrey Auctions). This work is still in progress. Another recent proposal developed at ETH Zürich for an architecture is described in [FSPl97] and first implementation results are presented in [FSPl98], *[COINS]*. Using a high-speed integrated services test-platform this work shows the feasibility of measuring large numbers of flows in real-time. Since the granularity is no longer a packet but a flow-state, less overhead is needed and the burden of charging and accounting can be put on recent router hardware.

Work on differentiated services is performed within the integrated services working group of the IETF. It is primarily based on the observation that per-flow state in routers as it is needed for reservation protocols such as RSVP can become a bottleneck in the Internet. Therefore, proposals have been made to provide light-weight reservations or priority schemes [ClWr97], [Wroc98]. No agreement on a possible introduction or standardization has been reached and work on charging and accounting options for such protocols is only starting slowly. For example, a proposal by Clark and Fang [ClFa97] describes a zone-based charging scheme that is based on packet tagging and dropping (in/out tagging). The proposal supports different service classes and has the nice property that charging is performed at the edge and at interconnection points of the network only. In this context, other proposals introduced the terms assured and premium service for prioritized service classes [NJZh97]. However, such proposals do not describe concrete methods how the money is collected and they do not study the economic implications of charging for integrated network services. Early work in this direction outside the Internet community, however, can be found in [Pau96] and [MacK97].

As a compromise between differentiated services and integrated services, recent work proposed to aggregate traffic in backbone routers. This raises interesting problems since there is no policing and end-systems must be trusted [GBHe97]. Handling reliability and security in integrated services charging and accounting platforms, besides cryptographic measures included in payment systems, is still an open issue and not dealt with by the IETF working groups.

3.2.4 Asynchronous Transfer Mode

For ATM-based B-ISDN the tasks of accounting, charging, and billing are required to the complete offer of integrated services. ATM accounting may be expected to serve as an embracing functionality capable of supporting the needs of service providers, direct customers, value added service providers, and other businesses. Virtual Private Networks (VPN) offer a possibility to satisfy special enterprise needs on closed networking environment where an ATM-based solution is highly qualified to obtain high bandwidths and guaranteed QoS. The “Broadband Network Infrastructure for the Swiss Federal Administration” (KOMBV) is a Swiss example for a VPN based on the Swisscom ATM network [BFI97]. It guarantees a maximum flexibility for a variety of different applications requiring multimedia services, eases management overhead, and reduced costs to operate the VPN. However, ATM-based intranets are only affordable for medium and larger enterprises because tariffing structures consider only high-volume customers [Eber98].

The telecommunications view of the terms accounting, charging, and billing has been preliminarily defined in [ETSI97], *[ETSI]*. Since these terms bear a number of interpretations within the literature their usage is rather difficult, *e.g.*, in contrast to the determination of accounting (cf. the introductory remarks of Subsection 3.2) ATM-accounting determines the collection of money and encompasses revenue sharing between operators and providers. This is complicated by the ATM definition of charging: Charging collects information in relation to a customer’s service utilization [BHHK96]. Finally, the determination of billing is similar, denoting the process of transforming the collected charging information for a customer to his bill. Valid ATM tariffs (cf. Paragraph 3.4.5) describe the applied economic model to calculate the corresponding amount of money to be paid. However, to provide a unified view on these ATM-related terms, the ongoing work in ETSI (European Telecommunications Standardization Institute) and related bodies needs to be monitored.

Basic principles on ATM charging describe the status of standardization and research. Two basic components of ATM tariffs are commonly identified [ETSI95]. The charges of an *access component* are typically fixed per installation and constant over billing periods. This charging does not require any on-line measurements. However, it should allow for compensating providers for required facilities for a service subscriber to access a service or services, *e.g.*, those facilities specifically provided to that service subscriber. In addition, they are independent of the utilization and related mainly to the type of access, such as capacity provided, maintenance, or redundancy. Charges of the *utilization component* should be in accordance with the service requested by the service subscriber. These charges in principle should be determined on the basis of network resources and additional functions required, providing the service to the service subscriber. The measurement of the utilization component usually has to be carried out on-line. Most current utilization charging schemes are based on saving parameters received through the ATM signalling, *e.g.*, including traffic contract, source and destination addresses, counting ATM cells during the ongoing call, and saving the set-up time and duration of the call.

Due to the fact that the more wide-spread deployment of ATM technology has been started just recently, charging schemes for ATM and its multiservices architecture have not been developed at all. Current research is being done by the ACTS projects CA$HMAN (Charging and Accounting Schemes in Multi-Service ATM Networks, *[CA$HMAN]*) and CANCAN (Contract Negotiation and Charging in ATM Networks, *[CANCAN]*) [Kuip97] as well as within the SPP ICS project CIMB (Charging Information Management and its Technical Implications in a Liberalized Broadband Telecommunications Environment, *[CIMB]*) [BHHK96] and [BHHK97].

Concerning standardization efforts, ETSI describes in [ETSI95] general charging principles in B-ISDN and possible parameters which could be relevant for B-ISDN charging in the future. The ATM specific usage measurement functions consist of relatively detailed components that are described very scarcely as possible options. According to [ETSI95] the following components reflect the utilization of switching and transmission resources: (1) called party by geographical distance, (2) duration which is related to time stamps associated with the start and the end of a connection and relevant variations during the connection, (3) time-of-day, day-of-week, day-of-the-year, (4) implicit priority (VPC – Virtual Path Connection/VCC – Virtual Channel Connection) and explicit priority (Connection Loss Priority mechanism), (5) provided QoS, (6) traffic contract parameters, (7) violation of traffic contract parameters, (8) reserved resources, (9) volume actually used which requires traffic measurement, and (10) multi-point aspects, if applicable. [Bell95] specifies the B-ISDN collection of charging information principles based on the existing procedures used in the N-ISDN infrastructure. Usage measurement is done on a volume basis (cell counts) only. The ATM Forum identified usage measurement functions based on Bellcore and ITU documents [ATMF98] and *[ATM-F]*.

The standardization process of ATM in the areas of accounting, charging, and billing is determined by a slow evolution and adaptation of common telecommunication standards. Currently, research is restricted to a few projects in the area of tariffing/charging, policing, and field trials.

3.2.5 Other Networking Technologies

Accounting and charging has been performed for public Wide Area Networks (WAN) such as the X.25 network, N-ISDN, and Frame Relay. Formerly PTTs (Post Telephone Telegraph), nowadays their privatized companies (telcos) are responsible for equipping these networks with accounting and charging soft- and hardware. Due to their connection-oriented characteris-

tics, accounting and charging is based on QoS parameters for connections, such as the call duration, the distance, and its bandwidth. Frame Relay utilizes the Committed Information Rate (CIR) and the Excess Information Rate (EIR) determining an type of available bit rate service. The D-Series of ITU-T recommendations covers general tariff principles to international private leased telecommunication circuits and networks [ITU-D.1]. In addition, a detailed discussion on further recommendations in this D-Series does not sound appropriate here due to the fact that these recommendations are fully established, in use for quite a number of years, and focussed on traditional networks and services. However, advanced services in emerging networks extending these traditional approaches, especially for Electronic Commerce platforms, need to take into account packet-based and connectionless networks. Therefore, the need to study these issues has been motivated and explained in Paragraph 3.2.3.

Within the Local Area Networks (LAN) environment, such as for Ethernet, FDDI (Fiber Distributed Data Interface), accounting and charging has not been implemented or designed in any generally known case. Reasons for this style of handling LANs are due to the fact that this networking equipment is bought once, utilized on a daily basis, depreciated after 3 to 5 years, and replaced with modern equipment starting the cycle again. In addition, the provision of these networks and their services, traditionally, has been organized in a centralized manner, such as from computing services or an infrastructure support group within an organization. The costs involved in this type of service provision have been allocated on a flat-fee basis to groups or departments. As far as known, no special accounting for a usage-based approach has been done for LANs. The New Zealand example shows that in particular traffic leaving regionally restricted networking area are due to special charges [Brow94], however, it has to be noted that this approach per se is independent on the LAN networking technology in use. Instead, the IP-based service is accounted and charged for (cf. Paragraph 3.2.2).

Finally, basic networking technologies, such as SDH/SONET (Synchronous Digital Hierarchy/ Synchronous Optical Network) or black fiber do not show an effort to integrate specialized accounting and charging methods. Mainly, capacity – that is a limited bandwidth for a certain time period – is sold or rented to customers. In fact, accounting and charging are not required on a low-level technical basis, since these networks or links do not serve as a shared medium, but as a deterministically multiplexed medium between different customers.

Therefore, an approach defining one technology “over” another technology, such as ATM over SDH/SONET or IP over ATM, normally does not care for the underlying technology to be accounted for, since (1) charging is done on a flat-fee basis, such as a special capacity for a certain duration and (2) services of the technology “over” are charged for. However, advanced and flexible networks are being extended to allow exactly for this missing gap to be filled-in. *E.g.*, accounting and charging in the Internet and in ATM networks are discussed elsewhere in this pre-study (cf. Paragraphs 3.2.2 to 3.2.4 above) as well as within other approaches, *e.g.*, [BCCK97] and [CFSt97]. Assuming a three layer value chain (ATM network operator, value added service provider, and the Internet user), trials were conducted to apply defined charging schemes. Problems remain with the relative price factors between variable and unspecified bit rates as well as with the volume of ghost traffic in a WWW-based environment [BCCK97]. Especially IP multicast services over ATM are considered in [CFSt97].

3.3 Billing and Payment Systems

As accounting and charging methods have been discussed above, billing issues and related payment system for dealing with electronic payments are elaborated within the following para-

graphs. In addition to transport services content being transported over interconnected networks has to be included in all billing considerations. Therefore, two separate and different components, transport and content, have to be billed in an integrated manner.

Billing:
Billing denotes the process of transforming the collected charging information for a customer to his bill. It includes the process where all the charging information, which was collected over a time period, i.e., one month, for a customer, are listed. The bill indicates the amount to be payed, it identifies the method of payment chosen or selected, and it is transferred electronically or paper-based to customers.

Method of Payment:
The method of payment defines a well-defined scheme, how money between two participants is exchanged, *e.g.*, customers and retailers. In general, electronic payment systems or traditional systems as utilized for traditional payment transactions are applicable.

3.3.1 One-Stop Billing

Integrated billing aspires to send only one bill to customers. Furthermore, customers should buy additional services form the same provider or service bundles. Extending this billing and service integration to contents is difficult because new interfaces to content providers must be offered which increases the complexity of billing systems. Generally two approaches can be distinguished:

- **Tight billing integration**: Charges for content or enhanced services are converted to transport charges, *e.g.*, support hotline using a 1-900 (U.S.) or a 157 number (Switzerland). Such an approach is very pragmatic and easy to implement, but has several drawbacks: (1) content charges are bound to the measured unit for transport services, in the case of voice, time. (2) It is difficult to separate content from transport cost on customers' invoices (lack of transparency). For enhanced services provided by the same company, *e.g.*, Swisscom voice mailbox, it might be easier, because the extra cost can be listed on bills as a fixed amount per use or month in addition to the transport fee.
- **Loose billing integration**: Only the service provider's billing facilities are used to put content or enhanced services onto the same bill. For example, AOL (America On-line) as an ISP (Internet Service Provider) charges for playing games which is additionally listed on the monthly bill. Such an integration is suitable and already practice for database services, information retrieval, multimedia services or retail of electronic products and services, *e.g.*, software or support by e-mail. The content service provider can choose freely the amount and time to charge for there service. In addition, bills can be presented transparently to customers.

Industry example: MCI's convergence billing targets an all-in-one billing system scalable to revenues to $30 billion (in 1996 $15 billion). Already 200 million transactions have to be processed and 5 million invoices are generated each month. MCI integrates charges for voice, cellular, Internet, and paging services on these invoices [MCI96]. As presented in [Willi97], the telephony model is not suitable for operators to provide and bill for services on the Internet.

Outsourcing billing: An interface to read raw or standardized usage data records must be provided in order to delegate the billing process. Processing records to bills, handling accounts, sending invoices and reminders can be outsourced [Pfyf98]. Such an option might be interest-

ing for smaller companies like start-ups or SMEs that cannot afford a full blown professional billing department.

Business process integration: Telecommunications service providers need to integrate the billing process into their corporate accounting and controlling instruments. Appropriate interfaces are available at both ends. From the technical systems that collect accounting records (*e.g.*, voice connections, Internet traffic measurements, etc.) such data is provided in a standardized form *[NMF]*. From the corporate accounting systems point of view, import interfaces allow the integration of this data. For example, SAP's solution for telecommunication businesses [SAP98] can import such records, but needs to process them in a separate subledger in order to reduce the high load and many database transactions on the company accounting system.

3.3.2 Payment Systems

Having discussed accounting, charging, and billing the determined amount of money to be charged needs to be billed. Therefore, payment systems are used to transfer money between two or more partners and they represent an important prerequisite for an Electronic Commerce platform. Although traditional payments methods, such as cash, cheques, invoicing, or direct debit, are applicable to an electronic marketplace, the idea of a fully integrated, electronic system can not be achieved easily. Therefore, the traditional procedure for buying goods (retailer offer, customer order, price call, payment, and goods delivery) has to be adapted to an electronic marketplace and electronic payment systems are required.

Since the focus of this pre-study is neither on payment systems per se nor on security issues in detail, the following discussions briefly outlines known payment systems only, but determine in detail, whether they are suitable for an electronic marketplace in terms of supporting customer care, accounting, charging, and billing issues for transport services and content. The user friendliness of payment systems is one aspect in relation to customer care, particularly during sales support (cf. Subsection 3.1 and [SWRa97]). The possibility to charge very small amounts of money (pico-payments, *e.g.*, below 1 ¢), small amounts (micro-payments, *e.g.*, below $5 and large amounts (macro-payments, *e.g.*, above $5) are evaluated in relation to charging methods. A strategy to select an appropriate payment system for supporting these different amounts of money is presented in [MaWi96]. Further details on payment systems and their technical and organizational design and implementation have been announced to be included in [Zurf98]. Additional overviews and further details can be obtained from [Bank96], [HiZi96], [HRSZ96], [JaWa96], [ScWi97], [StZi98], and *[SEMPER]*.

The steps for processing an electronic purchase transaction are illustrated in Figure 5 without considering a trust center or a trust hierarchy. An electronic offer for goods and services is offered freely on an electronic marketplace, such as a WWW-based (World-wide Web) server or some closed groups. In addition, this offer is optionally secured. A customer selects from this offer his personal choices and places an order with the retailer. This order already requires a trusted communication, since the payment method to be selected is included and the order must arrive unchanged and authorized at the retailers side. The determination of the final price, currency, and exchange calculation, which is important in an international market, commonly known as invoicing, is transferred to the customer. Again, a secure communication is optional. The customer processes the payment by sending a payment object, which depends on the selected payment method, to the retailer. In addition, banks and clearing centers may be

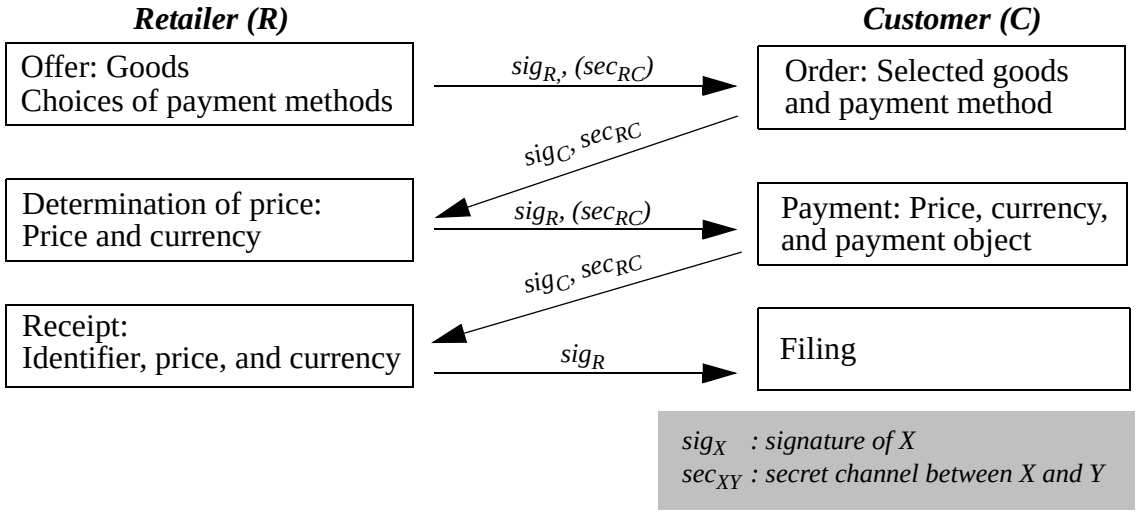

Figure 5: Electronic Steps for a Simple Purchase Transaction

involved to deal with the payment object, such as electronic money, cheques, or credit card payments. Finally, a receipt may be issued and goods or services are sent to the customer.

This scenario includes the central task of transforming locally accumulated payment information on the customer's side into monetary units to be sent to the retailer. In addition, payments may not be necessary for these purchased goods and services, but also for the communication itself. Depending on the strategy within an electronic marketplace, these costs are visible to every market transaction or are hidden behind the goods price. In any case, an accounting for these costs is required allowing for the definition of an open pricing interface which determines in a transparent manner all costs involved in a payment.

Table 2: Overview of Payment Methods

Category	Payment System	Anon–ymity	pico Payments	micro Payments	macro Payments	Security
Credit Card	S-HTTP-based	no	no	no	yes	SSL/RSA
	SET	no	no	no	yes	56 bit DES
	Cybercash/ Cybercoins	no	no	yes	yes	786 bit RSA/ 56 bit DES
Customer Accounts	First Virtual	no[a]	no	no	yes	no
	NetCheque	no	yes	yes	yes	Kerberos
	NetBill	no	no	no	yes	yes
Digital Cash	Millicent	no	yes	yes	yes	low[b]
	Chipcards/ Mondex/CAFE	yes	no	yes	yes	yes
	DigiCash/ecash	yes	no	yes[c]	yes	Asymmetrical schemes
	NetCash	yes	no	yes[d]	yes	variable

a. Since the customer identity is stored for the determination of a user profile (mainly advertisement incentives), anonymity cannot be guaranteed.

b. Decrypting a software-based card does not provide the appropriate scale in comparison to the revenue.

c. Every coin has to be checked for its validity.

d. Details unknown, however, micro payments have been stated as being efficiently possible.

Table 2 lists some of the known payment systems. They are categorized by credit card-based schemes, customer accounts, and digital cash (electronic money). The particular payment system is further identified by the achievable level of security and the anonymity. All approaches are applicable to on-line usage, but the types of payments vary according to the above introduced different amounts. This evaluation is based on the transactions costs per payment, including security services, set-up fees, and additional charges. As it can be seen in general, credit card-based payments are not suitable for any type of pico- and micro-payments. However, Millicent and NetCheque propose to offer exactly this facility, which is crucial for pico amounts of information being purchased or telecommunication services utilized during a market transaction.

Furthermore, billing frameworks, like iKP (Internet Keyed Payment Protocols) from IBM [Jans96], JEPI (Joint Electronic Payment Initiative) form W3C (World-Wide Web Consortium) [W3C98], and Java Commerce API from Sun [Java98], do not propose a special representation of electronic money, but should also be considered for billing services, such as Internet reservations, to achieve a greater flexibility.

3.4 Pricing and Economic Models

In this subsection the terminology pricing and tariffing is used interchangeably. This is based on the assumption of increasing deregulation of the telecommunications market and the emerging business orientation of the players in this field.

Pricing:
Pricing is the process of setting a price on a service or a product. This process is an integral and critical part of businesses and closely related to marketing. Prices can be calculated on a cost/profit basis or on the current market situation. In businesses selling telecommunication services prices are set on predefined services, where the quantity used is measured in units, time, distance, bandwidth, volume, or any combination thereof. These basic quantities are obtained from accounting devices in the network (cf. Subsection 3.2).

Tariffing:
Tariffing is a special case of pricing regulated by governmental and political economic impacts.

Traditional and widely accepted pricing models on networks offering a single service, *e.g.*, telephony or X.25, are provider centric, i.e. they are set to fixed values and re-issued whenever the competitive situation or regulations change. However, in an increasingly competitive environment, this approach is sometimes too slow and often too costly.

Although projects covering charging and accounting functionality on the network level try to achieve a high independence from pricing models, it has been found that pricing in general and usage-based pricing in particular can impose a high overhead on telecommunication systems [Vari96], [SCEH96]. Usage-based pricing for telecommunication services is especially interesting, because underlying resources used (satellites, spectrum, cables, routers/switches, and most notable operating personnel) are scarce and in some cases very costly. The often heard argument that scarcity of bandwidth can be solved by installing more fibers holds for certain links only. Operation of the whole network and providing quality end-to-end service is still an expensive venture. The strict flat-fee pricing (comparable to an all you can eat offer in a restaurant) has proven to be difficult in practice. For example, AOL (America OnLine) and other

ISPs turned to this pricing scheme which led to blocked dial-up phone lines at the Regional Bell Operating Companies which do not charge for local calls. From a customers point of view there is no more incentive to hang up a dial-up Internet connection when there is not charge per time or volume.

A fundamental problem with usage-based pricing, however, is the type and precision (granularity) of the collected accounting information which is used as a basis for pricing. For example, collecting connection time information of a telephone call rounded to 10 seconds means much less overhead than counting IP packets at each interconnection point. With current pricing models in single service networks there is also implicit information which can be used in the pricing process. However, if one aims for a more efficiently working [Shen95] multiple services networks for applications with varying requirements, this implicit knowledge is lost and must be recovered from the information made available by the protocols employed.

Using networks providing multiple service classes, such as ATM or the integrated services Internet, the precision used in pricing models depends much on the way of how communication is handled. A strictly connection oriented approach — this is the case for ATM networks — helps to reduce the overhead for accounting when usage-based pricing models are applied. On the Internet, new protocols like RSVP [ZDES93] can provide the basis for collecting usage-based accounting data.

The above mentioned efficiency maximization which is achieved in competitive markets has a theoretical foundation, the Pareto efficiency, where no player can be better off without hurting any other [Vari96]. In a globally distributed system, however, such competitive markets can be approximated only. Nevertheless, a gain in efficiency in the telecommunications service market means a surplus which will be distributed. Of course there are two views:

- **Customer View:** Budget constraints and spending strategies are used to get as much service for as little money as possible. The underlying economic principle could be formulated as “users buy the best bundle they can afford”. With software agents and brokers, automated, optimal spending strategies for finding telecommunication services bundles could be used to achieve this goal. Target services include, *e.g.*, phone, fax, Internet access, enhanced services, TV/VoD (Television/Video-on-Demand). They could be chosen by software agents working on behalf of customers in markets becoming more and more competitive. Users only need to express their preference and budget.
- **Provider View:** From a business point of view cost for providing telecommunication services must be recovered to guarantee a stable long-term existence of a provider. While pricing for traditional telecommunication services is well understood by companies, large as well as small ISPs still struggle to make a profit [McBe97]. Furthermore, providers want to maximize revenues.

Assuming higher market efficiency and the above described views of users and providers, *fairness* defines to what extent which party profits from the improved efficiency. Furthermore, fairness requires that customers pay the same price for the same telecommunications services at the same time.

In networks that do not charge for usage, i.e., the currently used Internet, fairness is defined in technical terms. For example, TCP/IP (Transmission Control Protocol/Internet Protocol) tries to serve all connections with the same throughput. Unfortunately, this works only for regional access without high delay variations between competing connections [ClFa97].

3.4.1 Pricing Models

Components of telecommunication pricing include three basic elements (cf. Figure 6). Firstly, an *access-fee* is collected which is usually a monthly charge for using an access link to the network. The price depends on the capacity of that link. Secondly, a *per-call* or *connection/reservation-setup-fee* may be charged. In connection-oriented networks or connection-less networks with reservation mechanisms setting up connections or reservations can be charged separately. Finally, a *usage-fee* can be used to charge services on time-, volume-, or QoS-basis. This fee determines the actual usage customers consume based on economic principles of marginal cost and market mechanisms. For telecommunication services network externalities play an important role. Independently of the basic transport service a content-fee can be introduced. Depending on the application content this fee may be omitted (*e.g.*, telephony, fax, e-mail services where the "content" is provided by the customer herself), billed separately (*e.g.*, Wall Street Journal on-line edition), or integrated into the telecommunication charging system (*e.g.*, 157/1-900 numbers, cf. Paragraph 3.3.1).

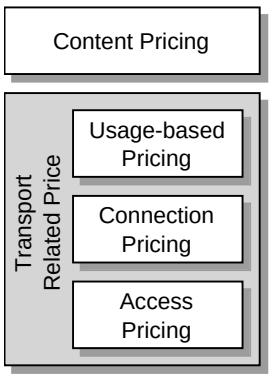

Figure 6: Components of Transport Pricing

These components are reflected in pricing schemes fully or partially. For example, voice services have all three transport components, but an IAP usually charges only for access and optionally for usage on a connect-time basis. Different combinations of the components and approaches to pricing of telecommunication services [Gade97] can be classified as follows:

1. **Flat-fee**: Typically used for residential Internet users. Usually, the traffic surges when flat-fee is introduced (most prominent example is AOL). This model is only used with current ISPs offering a single service class (best-effort). Another problem is the increased call blocking probability at POPs [Gira98].
2. **Usage-based**: General term for charging resources according to use. Parameters may include volume, time, or QoS-profiles [MaVa94].
3. **Reservation-based**: Usually a one-time fee per call. If reservations are limited in time this can become a primary component of the fee and longer calls must be composed by repeatedly reserving a service [FSPl98]. A fixed price may be set or the QoS-specification used at connection setup may be used to determine a price which is true for networks providing different service classes, such as ATM or IPng (IP next generation).
4. **Volume-based**: Volume pricing is popular for data services, *e.g.*, ATM [WKSo97].
5. **Service Class-based**: Integrated Services Networks offering QoS and this multiple service classes for different applications (*e.g.*, IPng, ATM) usually set different price classes, *e.g.*, base prices [FSPl97] and [WKSo97].

6. **Bandwidth**: Introduce price classes according to the capacity used. Offers the possibility of volume discounts.
7. **Spending caps**: Setting a cap (an upper limit on expenditures) on usage rates is popular with customers, who are uncomfortable with the open-ended risk of usage-based pricing. This approach is usually introduced in combination with another pricing model, *e.g.*, such as one based on dynamic market prices determined by auctions.
8. **Distance**: Increasingly unpopular, usually simplified by zones, provider networks or hop-counts.
9. **On-network and off-network traffic**: A pricing model to favor traffic which stays on a certain provider's network.
10. **Connect time**: Traditional telephone approach or sometimes used in addition to the flat-fee IAPs charge. Only applicable for uniform services using a single service class. An advantage concerns the low-overhead measurement method.

3.4.2 Public Switched Telephone Network

Many of the national telecommunication providers (telco), such as Deutsche Telekom, Swisscom, or British Telecom, and local private telephone providers offer a three-dimensional pricing scheme. This involves the three dimensions of (1) time-of-day, (2) distance, and (3) duration of a call. It shall be noted that the call setup procedure also requires resources, but regularly it is not charged for. A national example for the Swisscom can be found in Table 3 and for the Deutsche Telekom in Table 4. International rates vary according to the destination country. Furthermore, the fourth dimension in terms of a (4) fixed-rate monthly access and provision charge has to be added almost everywhere in the world. Finally, (5) an initial installation and physical connection charge may be required (cf. Paragraph 3.2.1).

Table 3: Phone Call Pricing (Swisscom)

Days	Time-of-Day	Local Call	Long-distance Call
Mo – Fr	8 am – 5 pm 7 pm – 9 pm	0.20 CHF/90 s	0.10 CHF/24 s
Mo – Fr	6 am – 8 am 5 pm – 7 pm 9 pm – 11 pm	0.10 CHF/180 s	0.10 CHF/48 s
Sa + Su	6 am – 11 pm		
Mo – Su	11 pm – 6 am	0.10 CHF/360 s	0.10 CHF/96 s

Most telcos apply a flat-rate monthly access charge, which currently equals 25,- CHF in Switzerland. They also apply this usage-based pricing scheme, where the time-of-day and day-of-week granularity may vary, the number of distance regions may encompass more than two, and the duration of the call is important. The metering of the duration may be based on charging units, such as above the "phone-unit" of 0.10 CHF and 0.23 DM respectively, or on a strict time measurement, *e.g.*, by seconds. Phone-units have to be paid in full, even though the full duration in seconds per unit has not been reached, which equals a numerical round up of the real usage. A per second measurement of the call duration represents is a more fine-granular method to determine the exact link utilization.

Besides these metered calls, a different approach is selected, as i.e. in some U.S. American cities, where local calls are free. This partial pricing scheme is similar to a flat-rate pricing on a

monthly flat-rate. Sharing of local phone access links and their costs is, *e.g.*, supported in India. A variety of other mixed approaches can be found, *e.g.*, where a limited number of calls or its synonym in terms of duration (time) are free per month and the additional ones will be charged.

Table 4: Phone Call Pricing (Deutsche Telekom)

Days	Time-of-Day	Local Call	Long-distance Call
Mo – Fr	9 am – 6pm	–	0.23 DM/12.5 s
Mo – Fr	5 am – 9 am 6 pm – 9 pm	–	0.23 DM/20 s
Sa + Su	5 am – 9 pm		
Mo – Fr	9 pm – 2 am	–	0.23 DM/25 s
Sa + Su	9 pm – 5 am		
Mo – Su	9 pm – 5 am	–	0.23 DM/120 s
Mo – Su	9 pm – 5 am	0.23 DM/240 s	–
Mo – Fr	5 am – 9 pm 6 pm – 9 pm	0.23 DM/150 s	–
Sa + Su	5 am – 9 pm		
Mo – Fr	9 am – 6 am	0.23 DM/90 s	–

As the telephone network and its local telephone links are being used for many ISPs to provide data communication access to the Internet, an integration of voice and data communications is forthcoming. Obviously, the Integrated Digital Services Network (ISDN) provides this feature of integration already for quite a while. However, ISPs require the telephone system to reach private homes without additional cabling investments. Most of today's ISP, such as AOL, Metronet, BlueWindow, or EUNet, charge a flat-rate access price in addition to the call and connection costs to be paid to the telco. If the number of ISP users dramatically increases, usage-based pricing schemes have to accompany ISPs to make their practical business viable.

Summarizing, telco's telephone pricing schemes already offer a variety of pricing approaches which is manifold in todays deregulated telecommunication services market. Although these approaches are suitable for connection-oriented services with fixed QoS attributes only, they offer a starting point for connectionless services. Further business areas, such as the power supply industry, sell volatile goods (electricity) and provide appropriate, dynamic pricing schemes. However, Internet communication services involve many more important issues, such as diverse QoS requirements, which make it necessary to design an adequate set of pricing schemes.

3.4.3 Traditional Internet

Originally, the Internet as subsidized as a research network by governments and non-commercial third parties. Pricing models for the traditional Internet service is based on the fact that there is only one service class. Moreover, the lack of accounting information led to very simple models. Most IAPs and ISPs charge only a monthly flat-fee ($19.95 has become a very popular price in the U.S.A.). Some ISPs charge additionally a time-based fee in the range of a few dollars per hour if a base amount of "free hours" is exceeded [Gira98].

As many economists predicted [McBe97] and [Stah97], the flat-fee model did not work for most smaller ISPs and recently also for AOL. The worlds largest ISP was forced to raise its flat-fee by $2 to $21.95 [Macl98]. Due to this provider centric, static pricing approach, such companies have to adjust pricing in a repetitive and costly process.

A retrospective analysis for the funding for the Internet during the last few years has been performed in [Noll97]. *E.g.*, based on the amount of Internet traffic carried in the NSFNET (in December 1995: 16,000 billion Byte) and the reported spendings of app. $25 million, a low-estimate cost of 1.6µ¢/bit can be calculated. These considerations allow for preliminary conclusions that billing in the Internet "would commence at a rate of 2µ¢/bit", however, which would have to be discounted for high volume traffic. Due to its emerging behavior into an integrated services Internet (cf. Paragraph 3.4.4 below) suitable pricing schemes need to be researched.

3.4.4 Integrated Services Internet

Since the Integrated Services Internet has yet to be deployed in the next years, no enhanced pricing models could be tested so far (cf. Paragraph 3.2.3). Research in this area focuses on discrimination of service classes and on usage-based pricing models. Projects concerned with pricing models for ATM networks recently began to investigate the integration of their service class model into the integrated services Internet model [WKSo97]. Economists working directly on the integrated services Internet model include [MacK97], *[INE (PRIE)]* and experimental pricing models have been described in [FSPl97], [FSPl98], and *[COINS]*.

The recently initiated differentiated services models [Wroc98] did not spawn much work in the field of pricing models yet. Clark is working on diffserv mechanisms and also describes experimental approaches to zone and QoS-based pricing schemes [ClFa97].

3.4.5 Asynchronous Transfer Mode

As the ATM technology in the WAN environment used to be controlled by PTTs formerly, tariffing schemes defined initial approaches for public ATM networks. This changes today due to private companies offering ATM services and pricing schemes. However, legacy ATM networks still rely on conventional tariff models as applied to telephone services. This status reflects the fact that telecommunication tariffs tend to follow an evolutionary rather than a revolutionary process [BHHK97], [RöHu98], *[CIMB]*.

Current implementations on ATM pricing models are based either on a flat rate, as for legacy leased line tariffs, or on a two-part pricing scheme which is monthly an access and usage based fee, as for legacy switched circuits tariffs. However, new proposals in recent research suggest different ATM pricing models to take into account various services classes offered by ATM. One approach [WKSo97], *[CA$HMAN]* suggests to remove distance-based parameters as defined within PSTN voice traffic (cf. Paragraph 3.2.1) and define usage in terms of cells, ATM-QoS, or bit speeds rather than connection duration. Table 5 illustrates an example for ATM services class prices per Mbit transferred. This allows for the definition of a wholesale pricing structure, while the access component (monthly flat rate proportional to access or port speed) and the usage component (proportional to the traffic volume depending on the QoS) are still distinguished (cf. Paragraph 3.2.4).

The basic charging for ATM is called "three tier charging" [Kuip97], where the set-up fee, the total of all duration fees, and the total of volume fees are included. However, as ATM provides

different service classes, it is not appropriate, *e.g.*, to charge for a constant bit rate traffic a volume charge. As the result obtained shows, various traffic types require different pricing approaches to make their special characteristics visible in economic incentives.

Table 5: ATM Services Pricing According to [WKSo97]

Traffic Class	Characteristics	Price	Typical Service
Variable Bit Rate (VBR)	Same as CBR, but input stream must arrive at not more than a predetermined peak rate.	0.2 $/Mbit	Interactive video
Constant Bit Rate (CBR)	Guarantees zero cell loss and negligible delay, provided input stream arrives at a constant rate.	0.1 $/Mbit	Voice
Available Bit Rate (ABR)	Guarantees no cell loss, provided that input stream adapts to the network's requests.	0.005 $/Mbit	Internet
Unspecified Bit Rate (UBR)	No guarantees at all.	0.0002 $/Mbit	Video-on-Demand

4. Index to Projects, Standards, and Products

As a number of projects, standards, and products in the area of customer care, charging, accounting, billing, and pricing is available, a brief comparison allows for a condensed overview as shown in Table 6 to Table 8. For a detailed provision of additional information see Appendix A to C as referred to by the “Page” column below.

Table 6: Alphabetically Ordered Overview of Cited Projects

Name	Customer Care	Charging	Accounting	Billing	Pricing	Page
BOURBON	(yes)	–	–	–	yes	p. 63
CA$HMAN	no	yes	yes	no	yes	p. 60
CANCAN	no	yes	yes	yes	yes	p. 61
CIMB	no	yes	yes	no	yes	p. 54
CM (PRIE)	no	no	no	no	yes	p. 74
COINS	no	yes	yes	(yes)	yes	p. 56
EDC (PRIE)	(yes)	no	no	no	yes	p. 73
EC (PRIE)	no	no	no	yes	no	p. 73
INDEX	(yes)	yes	yes	yes	yes	p. 71
INFORMEDIA	(yes)	yes	yes	yes	yes	p. 72
INE (PRIE)	no	yes	yes	no	yes	p. 72
MARX	–	–	yes	–	yes	p. 71
MOBAN	yes	no	no	yes	no	p. 57
NOLC	(yes)	–	no	no	no	p. 55
SEMPER	no	no	no	yes	no	p. 64
SIG PM	no	yes	yes	yes	yes	p. 74
SPECIAL	yes	no	yes	yes	yes	p. 62

Table 7: Alphabetically Ordered Overview of Cited Standards

Name	Customer Care	Charging	Accounting	Billing	Pricing	Page
ANSI	no	no	no	yes	no	p. 77
ATM-F	no	no	(yes)	no	no	p. 78
ETSI	no	yes	yes	no	no	p. 77
IETF	no	no	yes	no	no	p. 76
ISO	no	no	yes	no	no	p. 77
ITU	no	yes	yes	no	no	p. 75
NMF	no	yes	yes	(yes)	no	p. 79

Table 8: Alphabetically Ordered Overview of Cited Products

Name	Customer Care	Charging	Accounting	Billing	Pricing	Page
Arbor/BP	yes	-	-	yes	yes	p. 85
Calico	yes	-	-	-	-	p. 85
Clarify	yes	-	-	-	-	p. 86
CRM	yes	yes	no	yes	yes	p. 82
DBS	yes	yes	yes	yes	yes	p. 80
Eclipse	yes	no	no	yes	yes	p. 82
Econis	yes	-	-	-	-	p. 81
Lucent Internet CC	yes	no	no	no	no	p. 84
LHS ICC/BSCS	yes	no	no	yes	yes	p. 84
Notes/Domino	yes	no	no	yes	yes	p. 83
Novavox Smartphone	yes	-	-	-	-	p. 81
SAP	yes	no	no	yes	yes	p. 83

5. Conclusions

Electronic Commerce platforms offer a challenge for traditional markets to extend geographic limits by applying telecommunication services. Closed markets do not require specific telecommunication services, they only use pure transport services for interconnecting remote systems. However, an open Electronic Commerce marketplace needs to deal with the delivery of advanced telecommunication services, tangible goods, and products as well as with the product called telecommunication service itself, including future multimedia and integrated services, such as directory services, digital audio and video, multimedia conferencing services, electronic transactions, or Virtual Private Networks (VPN). General observations show that for an efficient and acceptable Electronic Commerce marketplace the following issues are required: clearly defined legal frameworks, such as liability or trade regulations, financially profound taxation acts, such as Value-added Tax or customs duties, and market-oriented pricing schemes that are based on retailer strategies.

Customer care assures the quality of a product or a service. Workflow-based approaches are required to link pre- and after-sales support with the activity at the point-of-sale. Commercially available systems provide sophisticated company-internal solutions which are based on a closed market for business-to-business systems. However, for an open market solution, industry standard interfaces need to be integrated vertically and horizontally depending on the business case. Company cooperation, more and more performed over the Internet, necessitates inter-workflow integration, possibly by agent technology for data exchange, business process execution, or information retrieval.

As the traditional information and telecommunication services are available in today's information society, the need for charging and accounting for advanced telecommunication services is emerging dramatically. Although solutions for single service class networks, such as the telephone network, exist and are applied successfully, Integrated Services Networks require a completely different approach. This is due to the inherent service multiplexing in such networks and due to a variety of service characterizations by different Quality-of-Service parameters. Prominent examples comprise the traffic classes for the Asynchronous Transfer Mode or the future integrated services Internet, where only technical issues for their service provision are being solved. Besides a very limited number of research projects being worked at, no substantial activity has been observed in the area of charging and accounting of Integrated Services Networks.

Billing for telecommunication services has been solved in a proprietary manner for single service networks, particularly within the telecommunications industry, as common business solutions depict. Although, new telecommunication services impose another degree of complexity to existing billing systems, this information technology and software engineering problem can be solved by development. However, an additional dimension burdens today's approaches by the demand to bill for content. This determines the stringent need to integrate concepts for interoperable billing solutions between content providers and telecommunication service providers, including the demand for open billing interfaces and standards in this area. In addition, charging and accounting for various transport services determines the requirement of pico- or micro-payments. As existing payment system are not well suited for this task, research is indicated in this area including cryptographic protocols for secure and authentic transmission of payments over Integrated Services Networks.

Due to the highly competitive telecommunication service provider market static and dynamic pricing schemes for telecommunication services are required. As the pricing for single service networks is understood, Integrated Services Networks still remain without a proper pricing model, and inadequate single dimension pricing schemes would have to be applied in practice. Therefore, these open questions remain and further research needs to be conducted for dynamic pricing schemes in Integrated Services Networks.

5.1 Hot Research Topics

This subsection discusses important topics for research in the field of charging, accounting, billing, and pricing. Customer care is not considered here, since the topic is well covered by commercially available products. In addition to these technical and economic topics that are to be addressed in future research, organizational and political issues have to be integrated, too.

1. **Accounting and Charging Protocols**
   Usage-based accounting and charging in packet-based networks is an unsolved research issue. Especially in Integrated Services Networks, such as the Next Generation Internet, usage-based accounting and charging is a very complex task. Therefore, *charging and accounting protocols and processes* for Integrated Services Networks need to be designed and engineered in a flexible way to support different services, pricing models, network technologies, and even allow for content charging as an integrated basic service.
   Expertise for this topic is needed from telecommunications equipment and router manufacturers, telcos, Internet software companies, large Internet access providers, technical universities (network research), accounting and billing software companies, and content providers.

2. **Convergence and Integration of Telecommunication Services**
   Integrated services on packet networks offer the advantage of simple network management and reduced personnel cost for service providers. With this *convergence* of different networks, in particular the telephone network and the Internet, it is necessary to study the feasibility of *combined multiservice network nodes*, i.e. integrated telephone switch and router systems and the *integration of computer and telecommunication services* (*e.g.*, Internet Telephony and Fax, Voice/E-Mail, information services) with respect to charging, accounting, and billing. Such new services could provide an interesting starting point for SMEs and start-up companies.
   Expertise for this topic is needed from telecommunications equipment manufacturers and technical universities (network research), SMEs, start-up companies in the telecommunications, software, or networking business.

3. **Incentive-compatible Pricing Models for Integrated Services Networks**
   The new competitive environment in telecommunications and recently developed protocols supporting flexible ad-hoc reservations of resources in networks provide the basis for new service businesses, such as *bandwidth brokerages* which trade these resources by using *open pricing interfaces*. These new possibilities require economists to research and test *incentive-compatible pricing models* for new telecommunications services, i.e. provided on globally available platforms, such as the Next Generation Internet. Such models need to take into account multiple service classes, dynamic pricing, and the integration of content and transport cost. Testing economic theories is only partially possible by analysis and simulation, thus, market experiments are needed for this research topic (cf. Paragraph 5.2).
   Expertise for this topic is needed from universities (microeconomic research and network research), telcos, Internet and other service providers, and large Internet access providers.

4. **An Environment for Trading Communities**
   A clear *legal environment* for providing and trading services in an information society is essential for a secure and safe market between private customers, business customers, and retailers. Coordination with business and economic models is an essential part of this work. *National* as well as *international aspects* of such markets must be studied to provide an environment that is *competitive and safe* at the same time.
   Expertise for this topic is needed from universities (policy, legal, and economic research), businesses, service providers, customers, and the government.

5. **Open Billing Systems**
   Although billing systems are covered by today's commercially available products, the situation is dramatically changing, when new telecommunications services are offered by a large number of providers. In such an environment a need for integration is created. *Open billing interfaces* can be used by businesses amongst themselves and by customers to consolidate bills. In conjunction with electronic payment systems, this process is streamlined and its cost is reduced.
   Expertise for this topic is needed from financial institutions, universities (microeconomic research, management sciences), and service providers.

5.2 Demonstrator and User Trial Topics

For the field of customer care, charging, accounting, billing, and pricing the following possible exemplary demonstration scenarios could be used as a starting point:

1. **New Media and Information Services**
   Such a scenario benefits from the cooperation of telecommunication service providers and content providers. More specifically, information retrieval on high-volume data such as video or image archives could be a challenge for both transport and content providers. Customer-centric support and services combined with smart advertisement channels can further enhance the experience for customers and increase revenues for providers.

2. **Enhanced and Integrated Telecommunication Services**
   A broad range of well-known services (telephony, paging, fax, location information, mailboxes, e-mail, web-based information services) are to be integrated, marketed, and priced as a bundled product. This approach serves as a test-case for an existing SME or a new start-up company in the area of advanced and integrated services.

3. **A Self-sustainable High-performance Network for Swiss Research**
   The goal is to setup and test a high-end telecommunication infrastructure which is sustained and expanded by the customers (i.e., without direct subsidies). Economic models and new technical platforms are used to study the incentives for such a trial. Applications running on top of this network would include teleteaching, conferencing, mobility of researchers, and virtual project group communication.

6. References

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A. Research Programs and Projects

This Appendix A introduces research programs and projects in a threefold geographic structure: Switzerland-based, European-based, and world-wide approaches. Each of these Subsections determines (1) research programs and (2) important projects. To obtain an immediate view on distinguishing or common details, all related work is presented in similar tables.

A.1 Swiss Approaches

A.1.1 Swiss Research Programs

Name:	Schwerpunktprogramm Information und Kommunikation – SPP I+K Priority Program Information and Communication – SPP ICS.
Abstract:	The SPP ICS is a scientific research program in information technologies and in telecommunications sponsored by the Swiss National Science Foundation. Main research themes are engineering of distributed applications and the associated networks in general as well as quality, security, and management aspects. Demonstrator projects will validate prototypes produced.
Timing:	1996 – 1999
Contact:	Swiss National Science Foundation – Schweizerischer National Fonds Wildhainweg 20 CH–3001 Bern, Switzerland Phone: +41 31 308 22 22 Fax: +41 31 301 30 09 URL: http://www.snf.ch
Partner:	Educational and research units (academic, industries, small and medium sized enterprises)

Name:	Schwerpunktprogramm Informatik-Forschung Priority Program Informatics Research – SPP IF
Abstract:	The SPP IF is a scientific research program in information technologies and in telecommunications sponsored by the Swiss National Science Foundation. Research themes have been “Secure, Distributed Systems”, “Knowledge Based Systems”, and “Massively Parallel Systems”.
Timing:	1992 – 1996
Contact:	Swiss National Science Foundation – Schweizerischer National Fonds Wildhainweg 20 CH–3001 Bern, Switzerland Phone: +41 31 308 22 22 Fax: +41 31 301 30 09 URL: http://www.snf.ch
Partner:	Educational and research units (academic, industries, small and medium sized enterprises)

Name:	Kommission für Technologie und Innovation – KTI Commission for Technology and Innovation – CTI
Abstract:	The Commission for Technology and Innovation is the federal office, responsible for the promotion of research and development. KTI (previously KWF) supports research and development programs carried out in cooperation with different partners. KTI assumes about 50% of the project costs. In most cases, it is this financial assistance which is used to cover costs arising at the educational institution involved.
Timing:	–
Contact:	Dr. Peter Kuentz, Secretary KTI Effingerstrasse 27 CH–3003 Bern, Switzerland Phone: +41 31 322 24 40 Fax: +41 31 322 21 15 URL: http://www.admin.ch/bfk
Partner:	Universities; federal technical institutes; other technical universities

A.1.2 Swiss Research Projects

Name:	Charging Information Management and its Technical Implication in a Liberalized Broadband Telecommunication Environment – CIMB
Abstract:	New switching and transmission technologies in the B-ISDN (Broadband Integrated Services Digital Network), *e.g.*, ATM – at least potentially – lend themselves to a very fine-grained acquisition of data to be used for charging purposes. Additionally, liberalization trends in the telecom market may lead to situations where a service offered to an end user is composed of various service components contributed by different providers. Since the investments made in telecommunications in general are of long-term nature, as a consequence it is important to provide on a technical level flexible mechanisms for acquisition, pre-processing, exchange and further processing of charging data so that products do not become obsolete when future telecommunication policies and market requirements demand modifications. The project basically is divided into three phases. The diverging viewpoints of the different players (network operators, service providers, equipment vendors) on the subject and the lack of a common basis in the literature and in standardization bodies require a more detailed description of the problem area (common terminology, baseline models of the network infrastructure with respect to charging, billing and tariffing). This will be developed in the beginning of the project. Models of the future telecommunication market sectors will be designed. Based on these models the charging data to be collected will be identified such that a fair, transparent and efficient charging and billing may take place. The resulting technical implications of the various tariffing models will be investigated. In particular the impact on network architecture and functionality in the network elements shall be determined.
Timing:	May 1996 - April 1998
Contact:	Dr. Franz Röhmer Alcatel STR AG Friesenbergstrasse 75 CH–8055 Zürich, Switzerland Phone: +41 1 465 25 66 Fax: +41 1 465 24 81 E-Mail: franz.roehmer@alcatel.ch URL: http://www.tik.ee.ethz.ch/~syt/projects/SytProjects.dhtml
Partner:	Computer Engineering and Communications Laboratory (TIK), ETH Zürich, Switzerland; Institute for Information Management (IWI), University of St. Gallen, Switzerland; Swisscom, Bern, Switzerland; Ingenieurschule TWI, Winterthur
Program:	SPP ICS

Name:	Networking and On-line Consulting –NOLC
Abstract:	Networking and On-line Consulting is part of the Virtual Software House (VSH) package. It comprises two linked research areas: (a) the specification and implementation of functions allowing electronic distribution and on-line consulting services (EDOC services) to be provided on the VSH demonstrator, and (b) the planning and implementation of a network infrastructure for the VDH demonstrator. EDOC services are concerned above all with: the secure and reliable distribution of software products and components; online advice, support and training; possibly in a later phase, electronic charging for services rendered. The ability to provide such services calls for suitable middleware to support distributed applications used in connection with a base communications infrastructure such as an ISDN/Internet platform. A network testbed is needed for the demonstrator. As worldwide accessibility is a key requirement for both electronic markets and support services, for pragmatic reasons a suitable combination of ISDN and Internet facilities should be used to start with.The goal of the NOLC-project is specifying a communication infrastructure for on-line marketing, consulting selling, and distributing software products.
Timing:	January 1996 – February 1998
Contact:	Christoph Denzler Computer Engineering and Networks Laboratory (TIK), ETH Zürich Gloriastrasse 35 CH–8092 Zürich, Switzerland Phone: +41 1 632 70 43 Fax: +41 1 632 10 36 E-Mail: denzler@tik.ee.ethz.ch URL: http://www.tik.ee.ethz.ch/Projects/NOLC/NOLC.html
Partner:	Institut für Technische Informatik und Kommunikationsnetze TIK, ETH Zürich; AWK Engineering, Zürich; Laboratoire des Systémes d'Exploitation, Federal Institute of Technology at Lausanne; Swisscom, Bern
Program:	SPP-ICS, Virtual Software House project package Project No. 5003-045329

Name:	Charging and Accounting of Integrated Internet Services – COINS
Abstract:	The need for providing a basis for accounting and charging schemes in the Internet requires network and resource models and mechanisms that are capable of defining and collecting information, such as number of packets transmitted, duration of transmission, or flow labels, being utilized to determine resource and service usage. Baseline evaluations in closely related areas of networking are intended to prepare a future-safe approach for the integration of accounting and charging schemes into the Internet of today and tomorrow. In addition, the specification of accounting schemes, particularly suited for packet-based networking is required. In particular, resource reservation techniques are emphasized in a first step due to guaranteed services as required for commercialized applications in a future Internet. On one hand, traditional network management schemes and, on the other hand, economic models gain advantage of these issues, since a causal connection is identified concerning the network and resource model and usage of these information for technical network management, such as identifying bottlenecks in routers or recognizing permanently congested links, or for charging schemes, such as paying a certain flat amount of money for lowly utilized links or buying permanent links. Authentication and security mechanisms are needed to protect users privacy. A to be specified network, resource, and economic models shall be particularly applicable to the Internet. The identification of communication services and resources that are worth paying and accounting for, provide the boundary conditions for the final selection of a suitable economic model. A prototypical implementation concerning resource reservation issues, QoS specification interfaces, and monitoring schemes allows for the flexible implementation and experimental integration of various pricing schemes and accounting techniques.
Timing:	July 1997 – June 1999
Contact:	Dr. Burkhard Stiller, George Fankhauser Computer Engineering and Networks Laboratory (TIK), ETH Zürich Gloriastrasse 35 CH–8092 Zürich, Switzerland Phone: 01 632 70 16 Fax: 01 632 10 35 E-Mail: stiller@tik.ee.ethz.ch
Partner:	Informal contacts are established with H. Einsiedler, EPF Lausanne, LRC, Switzerland; H. Fahner, J. Jähner, P. Christ, Rechenzentrum der Universität Stuttgart, Germany; G. Carle, M. Smirnow, GMD-FOKUS, Berlin, Germany
Program:	–

Name:	Mobile and Nomadic Banking – MOBAN
Abstract:	Private banking depends on the excellence of personal care and services to the clients; to enforce this care, a bank account officer visits periodically the clients. In such a mobile environment, the design and development of an adequate architecture and communication infrastructure providing security and reliability is required. Existing solutions for electronic payments and secure banking must be reviewed to suit the requirements of nomadic systems. Furthermore, the mobile nature of the system presents classical routing and roaming problems and opens promising research directions in topics such as strong authentication, geographical identification and data confidentiality and coherency. The main goal of the project is to develop a system with a secure protocol associated to a nomadic and/or mobile environment. The proposed research will result in a prototype system, to be developed in partnership between the University of Geneva and the American Express Bank of Switzerland. Close cooperation also exists with the ETHZ and an airline software company, Aerocomputer, is also a potential partner of the project.The project with the American Express Bank includes key items with respect to customer care, billing, accounting:
Timing:	April 1998 – March 2000
Contact:	Jose D. P. Rolim University of Geneva, Centre Universitaire d'Informatique 24, Rue General Dufour CH–1211 Geneve 4,Switzerland Phone: +41 22 705 7646 Fax: +41 22 705 7780 E-Mail: Jose.Rolim@cui.unige.ch
Partner:	American Express Bank, Atraxis, Aerocomputer
Program:	– (not yet)
Remark:	Mobility results in higher flexibility but brings forward new problems that should be dealt with. Customer protection: strong cryptographic protection will be devised together with other security aspects relatively unexplored in electronic banking protocols such as detecting and preventing transactions under attack and providing “transparent” security. Legal and administrative issues related to mobility and customer protection such as problems resulting from crossing jurisdictional borders. Logging and accounting are essential to the success of our system. A very significant effort will be devoted to design an appropriate architecture providing accuracy, integrity and confidentiality of logging information that may serve as a base to resolve potential disputes. Furthermore, however, dedicated to a financial application proposed by the private banking community, companies that develop software to airlines are interested in the system due to the inherent mobile framework.

A.2 European Approaches

A.2.1 European Research Programs and Initiatives

Name:	Advanced Communication Technologies and Services – ACTS
Abstract:	The ACTS Program was established under the Fourth Framework Program of European activities in the field of research and technological development and demonstration. The Program supports research and development in advanced communications in order to facilitate economic development and social cohesion in Europe. Under the Program different partners agree to work together as individual project consortia, pooling their knowledge and resources in pursuit of specific research objectives covered by the ACTS workplan. All ACTS research is conducted in the context of usage trials to ensure relevance of the results and to encourage a broadening of awareness of the benefits that advanced communications may bring. Twenty two National Host organizations support project experiments and act as a window to the many trials which are already being conducted within the countries concerned, and also internationally.
Timing:	1994 – 1998
Contact:	http://www.de.infowin.org/ACTS/ANALYSYS/INTRO/intro_s.htm
Partner:	Individual companies, public sector organizations, research institutes, schools and universities

Name:	Telematics
Abstract:	The general characteristics are R&D and focussed on Telematic services in different application areas. Generic telematic services and demonstrations are intended. Some projects selected to be funded relating Electronic Commerce, especially in the area of Transport, sometimes based on the EDI Infrastructure. “Telematics Applications” refer to the applications of informatics and/or telecommunications. Thus, for instance, it includes not only tele-training but also computer-based training; not only telemedicine, but also the patient multimedia medical record; not only tele-assistance for persons in precarious situation, but also computer interfaces for disabled and elderly persons; not only tele-management of traffic, but also in-car navigation and route guidance systems; not only CD-ROM databases, but also on-line trading of multimedia information content.
Timing:	1994 – 1998
Contact:	URL: http://www2.echo.lu/telematics/
Partner:	–

Name:	Technologies for Business Processes (TBP)
Abstract:	The general characteristics are focused on IT, Human Factors and Business Processes. About 20 projects (20 MECU) selected to be funded, some of which addresses Electronic Commerce in the areas of: supply chain processes, virtual teaming, customer care, and stock processes.
Timing:	1995 – 1998
Contact:	Terje Grimstad E-Mail: grimt@dg13.cec.be
Partner:	–

Name:	Chain NIA: Accounting Chain
Abstract:	The Network Inter-operability Group (NI) is primarily focused on issues of inter-operability between different types of networks. It encompasses the following aspects of interworking: physical level (*e.g.*, opto-electronic), network level (*e.g.*, signalling and control functions in homogeneous and heterogeneous networks; inter-operability between fixed & mobile networks, and optical & electrical networks; interfacing with service-provider networks) application level (*e.g.*, interfacing with content providers; user QoS) management aspects (*e.g.*, inter-operability between network management systems; ATM accounting schemes; guarantee and preservation of service quality). The objective of this Accounting Chain (NIA) is to provide recommendations (guidelines) on the question of how to charge for broadband communications services. Three key issues include the definition of a variety of charging schemes applying to the ATM services, definition of the TMN architecture relating to charging and the interfaces, and definition of the end user and value-added provider negotiation issues.
Timing:	ongoing
Contact:	Donal Morris Phone: +353 1 7045405 E-Mail: donal.morris@teltec.dcu.ie ULR: http://www.at.infowin.org/ACTS/ANALYSYS/CONCERTATION/CHAINS/NI/desc_nia.htm,
Partner:	BOURBON (AC001), CA$HMAN (AC039), CANCAN (AC014), E=MC2* (project of the TEN-IBC Action), GINA (AC220), JAMES (AC111), MISA (AC080), RENAISSANCE (AC100), SPECIAL (AC091)

A.2.2 European Research Projects

Name:	Charging and Accounting Schemes in Multi-Service ATM Networks – CA$HMAN
Abstract:	The goal of this project is to study and develop, implement, verify and compare charging and accounting schemes for ATM networks. This will be achieved by the development of appropriate pricing models, their efficient implementation in hardware and software, and the extensive use of National Host facilities for validation and for acquiring important user feedback.Technical Approach Appropriate pricing models for user services will be developed which address needs such as fair charging and economic usage of network resources. These models should be cost-effectively implementable and take advantage of existing traffic shaping and monitoring technologies. The features provided by existing technologies for policing and shaping network traffic will be enriched in order to support the new sophisticated pricing mechanisms and analyze the requirements of such mechanisms on the network management architecture. An open environment will be integrated for the fast implementation and testing a broad class of pricing models. Field trials will be performed in three National Host facilities for the validation of the models and for obtaining vital user response. Development of adequate pricing models to be used for the experiments. Implementation of pricing structures in hardware and software. Integration of experimental platforms at the National Host facilities. Provision of access to real users, and experimentation with real user traffic. Evaluation of user response to pricing mechanisms.
Timing:	–
Contact:	Dr. Georgios Manos INTRASOFT S.A. Adrianiou 2 St Athens 115 25, GREECE Phone: +30 1 6496620 Fax: +30 1 6925259 E-Mail: gmanos@isoft.intranet.gr URL: http://media.it.kth.se/SONAH/Acts/AC039.html and http://www.intrasoft.gr/cashman/Default.htm
Partner:	INTRASOFT SA Greece; ATecoM Germany; ICS-FORTH Greece; TELENOR Research Norway; ERICSSON AS Norway; University of Cambridge UK; ASCOM MONETEL France; Royal PTT Nederland NV Netherlands; LYNDEWODE Research UK; ASCOM AG Switzerland; ATT Bell Laboratories USA; University of California Berkeley USA; University of Aachen ISS Lab Germany.
Program:	ACTS – AC039

Name:	Contract Negotiation and Charging in ATM Networks – CANCAN
Abstract:	The project aims to provide research and technology development (RTD) in the area of ATM Charging and Broadband Service Contracts. The key objective of this project is to explore the nature of such contracts, both in their long-term aspects (which concerns service level agreements.) and in their short-term aspects (such as how aspects of the contract can be negotiated during connection establishment). The issues to be addressed in recommending methods of charging for ATM services are three-fold. Firstly, on what basis are charges to be made? Secondly, how will the charges be conveyed to the customer, and thirdly, how will users react to the charging scheme? This project seeks to answer all three questions. In addition, it is proposed to facilitate the customer in exploiting the flexibility of ATM by investigating the use of dynamic tariffs negotiated during connection set-up. The customer must have a means of controlling the user's response to changing tariff levels (since the customer and the user will typically not be the same entity); a protocol for dynamic contract negotiation would need links to ensure that the user must be sensitive to changes in prices. Relationship to Previous Work The consortium membership has been carefully selected to ensure an appropriate blend of expertise from all sectors of the broadband market to ensure that all viewpoints are accommodated.
Timing:	–
Contact:	Donal Morris TELTEC IRELAND Dublin City University Glasnevin, Dublin 9, IRELAND Phone: +353 1 704 5405 Fax: +353 1 704 5508 E-Mail: donal.morris@teltec.dcu.ie URL: http://media.it.kth.se/SONAH/Acts/AC014.html
Partner:	TELTEC Ireland; Nederlandse Phillips Bedrijven BV Netherlands; Cable and Wireless plc UK; Queen Mary and Westfield College University of London QMW UK; BNR Europe Ltd UK; Telecommunications Managers Association TMA UK; Analyses Limited UK; Telia AB Sweden; Lund Institute of Technology Sweden; Cap Volmac BV Netherlands; Telefonica I+D Spain
Program:	ACTS – AC014

Name:	Service Provisioning Environment for Consumers' Interactive AppLications – SPECIAL
Abstract:	One of the main objectives of SPECIAL is to elaborate an accounting and tariffing based billing concept for a variety of interactive multi media services in a broadband environment. At the same time it aims to develop and validate a concise customer care concept. All factors that contribute to the concept will be assessed in terms of their impact on network planning. In addition, a conditional access concept and a reverse channel approach which relate the service to the network aspects will be developed. The following key issues will be addressed by the project: Assessment of the impact of ATM networks on billing models. Definition of a scalable approach Integration of all components. Verification of models in an environment that is as realistic as possible Connectivity with other projects.
Timing:	–
Contact:	R. Diederichs VEBACOM GmbH Am Bonneshof 35 D–40474 Düsseldorf, GERMANY Phone: + 49 211 45 79 790 Fax: + 49 211 45 79 434 E-Mail:rolf.diederichs@X400.verbacom.lion.de URL: http://media.it.kth.se/SONAH/Acts/AC091.html
Partner:	VEBACOM GmbH Germany; Arcodan Denmark; Concepta Kommunikations und Gebäudetechnik GmbH Germany; ENERGIE Distributie Maatschappij von Oost en Noord Netherlands; ERICSSON Radio Systems AB Sweden; Forschungsinstitut für Telekommunikation an der Fernuniversität Hagen und an der Universität Wuppertal Germany; Health Online GmbH Co KG Germany; LION Gesellschaft für Systementwicklung mbH Germany; MEGANET Gesellschaft für Mehrwertdienste mbH Germany; Universität Osnabrück Institut zur Erforschung der Informationsgesellschaft Germany
Program:	ACTS – AC091

Name:	BrOadband Urban Rural Based Open Networks – BOURBON
Abstract:	Building on the work already accomplished in RACE, the BOURBON project seeks to address the issue of providing cost effective, scalable access to ATM based advanced services for SMEs in the wider context of Europe and the Information society. There are two parallel streams running through the proposal, one Technology focused, the other User focused. It is within the convergence of these streams that the project will ultimately seek to demonstrate scalable solutions that will allow SME based users access to services and applications in advanced communications. A key goal of the technical module would be to demonstrate the advanced features of ATM based networking that are only just becoming standardized. This would include the incorporation of switched ATM applications. It is therefore planned to utilize the National Host network infrastructure, supporting the Fourth Framework initiative, to facilitate the demonstration of interEuropean SME based application trials. This project will seek to explore the cost/benefit trade-offs inherent within the communications sector, with particular emphasis on the needs of SMEs both Urban and Rural.
Timing:	–
Contact:	Padraig Ryan Screenphones Ltd Finisklin Industrial Estate Sligo, IRELAND Phone: +353 71 41991 Fax: +353 71 41985 E-Mail: pryan@sligo.screen.ie URL: http://media.it.kth.se/SONAH/Acts/AC001.html
Partner:	Screenphones Ireland; K-NET UK; NorthWest Labs Ireland; Helsinki Telephone Company Finland; Athens Technology Centre Greece; Octopus Flexible Business Concepts Netherlands; EuroConseils Finland; LENTIC Belgium; Tellabs Ltd. Ireland
Program:	ACTS – AC001

Name:	Secure Electronic Marketplace for Europe - SEMPER
Abstract:	Networked information systems are experiencing a tremendous growth in terms of users and traffic as well as publicity. The foremost application, the Internet-based World Wide Web (WWW), is still dominated by free-of-charge information systems, but this is expected to change dramatically in the near future. The Web will be used for all sorts of electronic commerce and trade, prefiguring the daily routine on the Information Super-highways of tomorrow's Information Society. Numerous projects and services aim at electronic commerce via Internet. Many are US-based. Most of them aim at closed solutions and concentrate on electronic payments only. None of them aims at the complete problem posed by a secure electronic marketplace. Neither provides a coherent model or a comprehensive security architecture. SEMPER aims at providing an open, coherent and comprehensive approach for building the global secure electronic marketplace. This is done by defining a generic architecture that allows for specific configurations (e.g., some modules might not be required by some users, or might not be permitted in some countries) and ensures interoperability of different modules as far as possible.
Timing:	November 1995 – December 1997
Contact:	Gerard Lacoste Centre d'Etudes et Recherches IBM France F-06610 La Gaude, France Phone: +33-92-11-4807 Fax: +33-93-24-4545 E-Mail: lacoste@vnet.ibm.com URL: http://www.de.infowin.org/ACTS/RUS/PROJECTS/ac026.htm
Partner:	IBM France; Centrum voor Wiskunde en Informatica (CWI), Netherlands; Cryptomathic, Denmark; DigiCash, Netherlands; EUROCOM EXPERTISE, Greece; Europay International, Belgium; FINTEL sprl, Belgium; FOGRA Forschungsgesellschaft Druck e.V, Germany; France Telecom - CNET; GMD Forschungszentrum Informationstechnik GmbH, Germany; IBM Zurich Research Laboratory, Switzerland; INTRACOM, Greece; KPN Research Netherlands; Otto-Versand, Germany; R3 security engineering ag, Switzerland; REGIONLINK SC, Belgium; Sintef Telecom, France; System Synthesis Limited, United Kingdom; University of Dortmund, Germany; University of Freiburg, Germany; Universität Freiburg/ Breisgau, Germany
Program:	ACTS–AC026

Name:	Charging Schemes in ATM Networks – NIA–G1
Abstract:	This guideline satisfies both user and network operator requirements (including the QoS level provided to the user, with respect to the negotiated charging model). This guideline specifically covers modeling issues. It offers recommendations for the structure of feasible or applicable charging models which satisfy both user and network operator requirements. In a broadband network an important role of charges should be to convey feedback to a connection about its resource usage, and information to the network about the traffic characteristics and the quality of service requirements of the connection. The challenge is to devise algorithms that can be explained to customers, and can be implemented in hardware and software. Guideline Objectives: Successful deployment of ATM services in a competitive Europe-wide context depends on strategic choices such as the selection of suitable tariff structures. This guideline develops a range of ATM charging and accounting schemes to support usage-based charging, cost-recovery & effective management of congestion. The objective of the guideline is to facilitate access and interoperability among vendor-independent ATM network providers and users. The analytic work is based on economic and statistical modeling of the trade-offs and resource-sharing inherent to ATM connections. The schemes' feasibility is based on initial trial results obtained in ACTS multiusage trials. Guideline Rationale: Charging can play an important role in effectively managing congestion. Charges will of course be determined in part by the competitive strategies of service providers. However, it is likely that good charging strategies will be based on usage of network resources. Economic theory suggests that usage-based charging will be employed by service providers in the case of perfect competition. Moreover, in a broadband network an important role of charges is to convey feedback to a connection about its resource usage, and information to the network about the traffic characteristics and quality of service requirements of the connection. The challenge is to devise algorithms that can be explained to customers, and can be implemented in hardware and software. This guideline introduces a framework of charging models that attempts to meet these requirements.
Timing:	January 1996 – September 1997
Contact:	Marion Raffali-Schreinemachers (Guideline Editor) E-Mail: m.j.e.raffali@research.kpn.com URL: http://www.uk.infowin.org/ACTS/ANALYSYS/CONCERTATION/nia1-sc.htm
Partner:	Participating projects: CANCAN AC014, CA$HMAN AC039, SPECIAL AC091, Renaissance AC100, JAMES AC111, GINA AC220
Program:	Guideline: NIA-G1

Name:	Requirements on Accounting Information Model – NIA-G2
Abstract:	The objective of this guideline is to facilitate common understanding of the technology mechanisms which underlie an on-line distributed accounting system. This guideline is related to NIAG1 - charging schemes. A better understanding of ATM traffic-shaping, policing, and QoS requirements is very useful to equipment manufacturers who need to reduce presently substantial cost and complexity of accounting and billing. The requirements on the processing and monitoring capabilities of the network and user equipment for supporting the charging mechanisms recommended in NIG-G1 have to be identified for successful implementation. Requirements on the architecture for traffic shaping and policing equipment also have to be identified and recommendation on the network management architecture for accounting have to be made in order to make any charging system transparent, safe and user-friendly.
Timing:	January 1996 – September 1997
Contact:	Christian Bitard E-Mail: bitard@sgy.tel.telis.fr URL: http://www.uk.infowin.org/ACTS/ANALYSYS/CONCERTATION/nia2-sc.htm
Partner:	CANCAN AC014, CA$HMAN AC039, MISA AC080, SPECIAL AC091
Program:	Guideline: NIA-G2

Name:	Expected Effects of the Accounting Chain Model – NIA-G3
Abstract:	This guideline contains information which may be of use to marketing departments of network operators. The guideline represents the views of large corporate users on the topic of charging for ATM. The overriding messages to come from the users on ATM Charging are that charging should avoid surprises in telecommunications managers bills charging should not be based on network congestion it must be possible to audit the basis of the bill. ATM networks will provide a wide range of bearer capacities and supported services. The flexibility of the network means that users have opportunities to exploit in a range of creative ways the network resources. The objective of this guideline is to develop customer value-based charging parameters and identify the effects and likely impact in terms of ATM contract negotiations, call detail record exchange, etc.
Timing:	January 1996 – September 1997
Contact:	Donal Morris E-Mail: donal.morris@teltec.dcu.ie URL: http://www.uk.infowin.org/ACTS/ANALYSYS/CONCERTATION/nia3-sc.htm
Partner:	BOURBON AC001, CANCAN AC014, CA$HMAN AC039, SPECIAL AC091, Renaissance AC100, GINA AC220, E=MC2 B3010
Program:	Guideline: NIA-G3

Name:	Charging Strategies – NIA-G4, Interconnection & Charging – NIA-G5
Abstract:	–
Timing:	Start: Autumn 1997
Contact:	URL: http://www.uk.infowin.org/ACTS/ANALYSYS/CONCERTATION
Partner:	–
Program:	Guideline: NIA-G4, NIA-G5

Name:	European Initiative on Electronic Commerce
Abstract:	The aim of this European Initiative is to encourage the vigorous growth of electronic commerce in Europe. A fast-moving sector, electronic commerce will have a considerable impact on Europe's competitiveness in global markets. Building upon the Commission's work to date, it provides a coherent policy framework for future Community action, and aims at establishing a common European position to achieve global consensus through international negotiations.
Timing:	Launched: Autumn 1997
Contact:	URL: http://www.cordis.lu/esprit/src/ecomcom.htm
Partner:	–
Program:	–

A.3 World-wide Approaches

A.3.1 World-wide Research Programs

Name:	Program for Research on the Information Economy – PRIE
Abstract:	1. Internet and Network Economics Economics of the Internet: PIARA: Pricing for Internet Addresses and Route Advertisements Economics of the Service Architecture Network Pricing Efficiency Simulations Markets for Reserving Resources in Advance 2. Economics of Digital Content The Market for Evaluations Pricing Electronic Access to Knowledge (PEAK) Electronic Commerce Comparing and Selecting Digital Payment Mechanisms Anonymity, Trust, and Collective Action in Public Spaces Trust Management Digistamps 3. Computational Markets MARX Market-Oriented Programming The Michigan AuctionBot
Timing:	–
Contact:	University of Michigan URL: http://www.si.umich.edu/~prie/Projects/projects.html):
Partner:	various (cf. separate projects below)
Program:	Joint program at University of Michigan with sub-projects (cf. Abstract)

Name:	Information Network for SMEs
Abstract:	This initiative focuses on the infrastructure, such as Internet and distributed multimedia databases, for an information network for SMEs.
Timing:	1995
Contact:	Yoshihiko Sumi E-Mail: syaa2169@miti.go.jp
Partner:	–
Program:	Japan

Name:	Electronic Commerce Support
Abstract:	This initiative focuses on Electronic Commerce support in terms of the exchange of information, solve important issues: security, privacy, IPR (Intellectual Property Rights). An international cooperation on important topics and the development of new applications is intended to support advanced applications for Electronic Commerce
Timing:	1995
Contact:	Yoshihiko Sumi E-Mail: syaa2169@miti.go.jp
Partner:	–
Program:	Japan

Name:	Integrated Next Generation Electronic Commerce Environment Project
Abstract:	Electronic Commerce over Internet using the latest state of the art technology. The focus development of Electronic Commerce applications, and experiments based on the infrastructures of Internet and ATM networks. The information services include Electronic Commerce applications, security, and network scalability issues. It involves the economic activation by experiment of Electronic Commerce on the Internet, the SME Participation in an experimental Environment. Finally, the creation of new businesses by developing advanced multimedia applications such as 3D through Internet and ATM networks the development of next generation Electronic Commerce System using advanced multimedia applications.
Timing:	1995 – 1997
Contact:	Yoji Hasegawa E-Mail: yhase@comm.mpt.go.jp URL: http://www.mpt.go.jp/g7web/Marketplace/Asabudai-Research.html
Partner:	Telecommunications Advancement Organization of Japan (TAO); Telecom Services Association of Japan (TSA); Foundation on Promotion of Telecommunication services (FPT); Japan Electronic Messaging Association (JEMA)
Program:	G7 Pilot Projects, Japan

Name:	A Global Marketplace for SMEs
Abstract:	The first specific objective is to contribute to the development of a global electronic environment for the open and non-discriminatory exchange of information (*e.g.*, data on technologies, products, human resources), overcoming obstacles of distance, time and country borders, for the benefit of SMEs. The second specific objective is to expand global electronic commerce in order to enable enterprises to carry out their business operations/management more effectively and more profitably.
Timing:	Launched late 1997
Contact:	Secretariat European Commission, DG III/F-6 Mr. Paul Timmers Fax: +32 2 296.83.87 E-Mail: ecommerce@www.ispo.cec.be URL: http://www.ispo.cec.be/Ecommerce/g7init.html
Partner:	G 7 Nations
Program:	–

A.3.2 World-wide Research Projects

Name:	Internet Demand Experiment – INDEX
Abstract:	New accounting and pricing methods for the Internet will be investigated. The demand of a user group (160 representative users on the Berkeley campus over 2 years) will be measured as a function of QoS, application and pricing structure. An end-to-end system offering attractive price-quality combinations is being offered to the participants. The results will show how demand varies with user experience and pricing structures and how networks with growing demand can be sustainable self-financed.
Timing:	Start: August 1996
Contact:	Departments of Electrical Engineering, Computer Science, and Economics UC Berkeley P. Varaiya, R. Edell, H. Chand. Advisors: H. R. Varian, D. McFadden
Partner:	Funding: Industry, state and federal funding
Program:	–

Name:	Michigan Adaptive Resource eXchange – MARX
Abstract:	Build first operational demonstration of a comprehensive market in network services
Timing:	Start: May 1997
Contact:	University of Michigan Electrical Engineering and Computer Science Department, Economics Department, and School of Information M. Wellman, S. Jamin, J. MacKie-Mason URL: http://ai.eecs.umich.edu/MARX/
Partner:	–
Program:	DARPA/ITO's Information Survivability program

Name:	Digital Video Library – INFORMEDIA
Abstract:	Speech recognition, image sequence segmentation; user interface display and control tools; text indexing, search and retrieval; video servers; network streaming protocols; dynamic pricing algorithms; payment systems; testbed-demo; network accounting of copyright usage.
Timing:	–
Contact:	Carnegie Mellon University, Computer Science Department URL: http://www.informedia.cs.cmu.edu/info/im-proposal.html
Partner:	Start: November 1994
Program:	NSF 93-141, Research on Digital Libraries

Name:	Internet and Network Economics - INE (PRIE)
Abstract:	*Economics of the Internet*: J. MacKie-Mason, NSF grant (SBR-9230481) for "Economics of the Internet". This project is studying issues involving pricing of transport and content, architecture, and mechanisms for accounting and billing. (Partners: Scott Shenker, Xerox PARC, and Hal Varian, University of California, Berkeley.) *PIARA: Pricing for Internet Addresses and Route Advertisements*; Most other work on Internet pricing focuses on bandwidth as the scarce resource. This paper focuses instead on two somewhat more static resources, IP addresses and router table entries, and argues that they should be allocated through economic rather than political mechanisms (Partners: Yakov Rekhter, Cisco, and Steve Bellovin, AT&T Labs). *Economics of the Service Architecture*. Information network technology is converging: it is already possible to deliver data, voice and video simultaneously over a single wire, and soon it will be a commercial reality (Partners: Scott Shenker, Xerox PARC, and Hal Varian, University of California, Berkeley). *Network Pricing Efficiency Simulations*. Jeff MacKie-Mason is undertaking network simulations of various pricing mechanisms. The objective is to test the relative performance characteristics and feasibility of various proposals. (Partners: Liam Murphy, Auburn University.; John Murphy, Dublin City University, Ireland.) *Markets for Reserving Resources in Advance*. Jeff MacKie-Mason has developed a model for efficiently reserving network bandwidth in advance. This is one approach to dealing with the poor quality of high-bandwidth, multimedia services in a public cell-switched network.
Timing:	–
Contact:	University of Michigan URL: http://www.si.umich.edu/~prie/Projects/projects.html
Partner:	(cf. Abstract above)
Program:	PRIE

Name:	Economics of Digital Content - EDC (PRIE)
Abstract:	*The Market for Evaluations*: Recent developments in computer networks have driven the cost of distributing information virtually to zero, creating extraordinary opportunities for sharing product evaluations. We have developed pricing and subsidy mechanisms that operate through a computerized market and induce the efficient provision of evaluations. The mechanisms overcome three major challenges: first, evaluations, which are public goods, are likely to be underprovided; second, an inefficient ordering of evaluators may arise; third, the optimal quantity of evaluations depends on what is learned from the initial evaluations. *Pricing Electronic Access to Knowledge* (PEAK): Jeff MacKie-Mason and Juan Riveros are working with the University Library, the digital document production team, and a major publisher on a field experiment of priced electronic scholarly journals. This project will run from 1996 through 1998.
Timing:	–
Contact:	University of Michigan URL: http://www.si.umich.edu/~prie/Projects/projects.html)
Partner:	Partners: Chris Avery and Richard Zeckhauser, Harvard University Kennedy School of Government
Program:	PRIE

Name:	Electronic Commerce - EC (PRIE)
Abstract:	Comparing and Selecting Digital Payment Mechanisms. J. MacKie-Mason and K. White have developed a method for comparing and selecting among the plethora of emerging digital payment mechanisms. They have prepared a comparison of 10 such systems, *e.g.*, NetBill, eCash, First Virtual), as well as 7 conventional types of money, against a vector of 30 different characteristics. Anonymity, Trust, and Collective Action in Public Spaces, Trust Management, and Digistamps are researched.
Timing:	–
Contact:	University of Michigan URL: http://www.si.umich.edu/~prie/Projects/projects.html)
Partner:	–
Program:	PRIE

Name:	Computational Markets - CM (PRIE)
Abstract:	MARX Market-Oriented Programming The Michigan AuctionBot
Timing:	–
Contact:	University of Michigan URL: http://www.si.umich.edu/~prie/Projects/projects.html)
Partner:	–
Program:	PRIE

Name:	Special Interest Group on Pricing Models – SIG PM
Abstract:	The accounting SIG will aim of issues that meet ATM charging necessities. These discussions will aim in the involvement of users that are aware of the ATM Network capabilities and will provide relevant impact. An initial set of questions have been designed within CA$HMAN in order to involve the users in the evaluation process. These questions aim to identify how educated the users are and what are the means that they have to control their traffic with respect to the tariffs they pay: For what applications do you use ATM traffic? What do you know about the traffic that you generate (peak rate, mean rate, burstiness, call duration)? What facilities do you have to measure or estimate your traffic characteristics? What facilities do you have to shape your traffic (e.g., to set peak rates)? What ATM services would you expect to use (VBR, CBR, ABR, UBR)? What quality of service requirements do you have? Do you expect the network to offer a simple tariff structure (e.g. just related to call duration and peak rate) or a complex tariff structure (dependent on traffic characteristics)? How many connections may be run at the same time from this user? The next steps of the charging chain will be to evaluate the outcome of the questionnaire and to identify the issues for traffic shaping and policing that influence the accounting issues.
Timing:	–
Contact:	Dr. Gerasimos Tinios E-Mail: tinios@isoft.intracom.gr URL: http://www.intrasoft.gr/cashman/Default.htm
Partner:	CA$HMAN AC039, ASSICOM, and CANCAN AC014
Program:	–

B. Standards

This Appendix B contains relevant standards related to charging, accounting, and billing.

Name:	Recommendations ITU-T D Series - ITU-T D
Abstract:	The explicit coverage of “General tariff principles” is found in the D series of ITU-T recommendations
Reference:	http://www.itu.int/itudoc/itu-t/rec/d/
Dates:	–
Remarks:	A complete list of standards is not included in this pre-study.

Name:	Recommendation ITU-T D.1: General principles for the lease of international (continental and intercontinental) private telecommunication circuits and networks
Abstract:	D.1 sets out the general principles and conditions applicable to international (continental and intercontinental) private leased telecommunication circuits and networks, taking into account opportunities available to Administrations, or other organizations or persons to enter into special arrangements, subject to national laws (including national regulations), for the establishment, operations, and use of international private leased telecommunication circuits. Recommendation D.1 also indicates what is to be understood by the terms international private leased telecommunication circuits and national extensions. The international private leased telecommunication circuit service consists of making dedicated international telecommunication circuits available to a customer for use on the terms and conditions which may be set out in a lease agreement between the customer and the Administration of the country at each end of the circuit. Customers may also combine a series of such circuits to establish international private leased telecommunication circuit networks. Recommendation D.1 precises the conditions of lease (technical information to be provided by the customer, technical requirements, transmission quality, extraordinary circumstances), the conditions of use, the access (interconnection) to public networks, the principles applicable to duration, charging and cancellation of lease, particularly the provisions for allowances for interruptions.
Reference:	http://www.itu.int/itudoc/itu-t/rec
Dates:	July 1991
Remarks:	–

Name:	Internet Engineering Task Force - IETF
Abstract:	The Internet Engineering Task Force (IETF) is a large open international community of network designers, operators, vendors, and researchers concerned with the evolution of the Internet architecture and the smooth operation of the Internet. It is open to any interested individual. The actual technical work of the IETF is done in its working groups, which are organized by topic into several areas (*e.g.*, routing, transport, security, etc.). Much of the work is handled via mailing lists. The IETF working groups are grouped into areas, and managed by Area Directors, or ADs. The ADs are members of the Internet Engineering Steering Group, or IESG. Providing architectural oversight is the Internet Architecture Board, or IAB; the IAB also adjudicates appeals when someone complains that the IESG has failed. The IAB and IESG are chartered by the Internet Society (ISOC) for these purposes. The General Area Director also serves as the chair of the IESG and of the IETF, and is an ex-officio member of the IAB. The Internet Assigned Numbers Authority (IANA) is the central coordinator for the assignment of unique parameter values for Internet protocols. The IANA is chartered by the Internet Society (ISOC) to act as the clearinghouse to assign and coordinate the use of numerous Internet protocol parameters.
Reference:	http://www.ietf.org
Dates:	
Remarks:	The IETF has experienced a tremendous shift from academic dominance to a business and product oriented organization recently.

Name:	Standards and drafts mostly based on ITU-T recommendations - ETSI
Abstract:	Many ETSI charging/accounting standards and drafts cover the areas Global System for Mobile Communications (GSM), Universal Personal Telecommunication (UPT), Cordless Telephone Mobility (CTM), and Universal Mobile Telecommunications System (UMTS). Accounting issues are also discussed in the two ETSI Projects (EP) “ATM Services Interoperability (EASI)” and “Multimedia Terminals and Applications (MTA)”.
Reference:	http://www.etsi.org
Dates:	–
Remarks:	A complete list of standards is not available in this pre-study.

Name:	ANSI Accredited Standards Committee (ASC) X.12
Abstract:	This standard is mostly used in North America, and it was developed by volunteers from industry and government, mostly under the auspices of the ANSI Accredited Standards Committee (ASC) X.12 in Alexandria, Virginia. It is similar in nature to EDIFACT, with different names but similar structures for the sub-elements of an EDI Interchange. There is a further level of indirection in an X.12 Interchange - Interchanges contain Functional Groups, which contain sets of the same type of Transaction Set, as EDI Messages are called.
Reference:	http://ganges.cs.tcd.ie/4ba2/edi/ansi.html
Dates:	–
Remarks:	–

Name:	Considerations on Network Mechanisms for Charging and Revenue Accounting - ETSI
Abstract:	This ETSI Technical Report document shows general guidelines for determination of charging and revenue accounting parameters. The document furthermore shows the general guidelines for technical mechanisms to register any event or parameter in relation to users transfer messages via telecommunication networks, events or parameters which may be used for charging. Guidelines are also given concerning mechanisms for revenue accounting between providers of network support and of telecommunication services, contributed to the same call and jointly billed.
Reference:	NA 2/142 - DRAFT DTR/NA 010040 – Version 10
Dates:	03.10.1997
Remarks:	This draft considers telecommunication services at a technical level.

Name:	International Organization for Standardization “Management Framework” Part 4 of Information Processing Systems Open Systems Interconnection Basic Reference Model - ISO-OSI
Abstract:	The OSI accounting model defines three basic entities: (1) The METER which performs measurements and aggregates results of those measurements, (2) the COLLECTOR which is responsible for the integrity and security of METER data in short-term storage and transit, and (3) the APPLICATION which processes, formats, and stores METER data. APPLICATIONS implicitly manage METERS.
Reference:	ISO IS 7498-4
Dates:	1984
Remarks:	–

Name:	Management Specifications – ATM-F
Abstract:	Accounting Management is not yet covered by ATM Forum Management specifications. Available Specifications cover: 1. Customer Network Management (CNM) for ATM Public Network Service (af-nm-0019.000, October 1994) 2. M4 Interface Requirements and Logical MIB (af-nm-0020.000, October 1994) 3. CMIP Specification for the M4 Interface (af-nm-0027.000, September 1995) 4. M4 Public Network view (af-nm-0058.000, Mar, 1996) 5. M4 "NE View" (af-nm-0071.000, January 1997) 6. Circuit Emulation Service Interworking Requirements, Logical and CMIP MIB (af-nm-0072.000, January 1997) 7. M4 Network View CMIP MIB Spec v1.0 (af-nm-0073.000, January 1997) 8. M4 Network View Requirements & Logical MIB Addendum (af-nm-0074.000, January 1997) 9. ATM Remote Monitoring SNMP MIB (af-nm-test-0080.000,July 1997) Technical Working Group is active in the following management areas: 1. Enterprise/Carrier Management Interface (M4), Requirements & Logical MIB, SVC Function NE View V2.0 (work in progress) 2. Enterprise/Carrier Network Management (M4), SNMP MIB (final ballot) 3. Carrier Interface (M5), Requirements & CMIP MIB (work in progress) 4. Carrier Interface (M5), Requirements & CMIP MIB (work in progress) 5. Management System Network Interface Security Requirements & Logical MIB (work in progress) 6. ATM Access Function Specification Requirements & Logical MIB (straw ballot) 7. M4 Requirements & Logical MIB Network View v2.0 (work in progress)
Reference:	http://www.atmforum.com
Dates:	–
Remarks:	Detailed abstracts of specifications are not included in this pre-study.

Name:	Network Management Forum – NMF
Abstract:	NMF is a non-profit, global consortium of service providers, equipment suppliers and software developers whose members work together to produce practical, cost-effective solutions for improving the management of public networks and services. NMF serves as an facilitator and provides the telecommunications industry with leadership in areas crucial to success in today's competitive global market. NMF publishes a range of business and technical agreements, reference guides and standards-based specifications which enable operational support systems, business support systems and network management systems to be effectively integrated. NMF provides a business process model and interfaces on different levels: invoice and collection (billing records), rating and discounting (uniform usage record), and usage based performance collection (raw usage data records)
Reference:	NMF 1201 Mt. Kemble Avenue Morristown, NJ USA 07960 Phone: +1 973-425-1900 Fax: +1 973-425-1515 E-Mail: info-request@nmf.org URL: http://www.nmf.org/
Dates:	–
Remarks:	–

C. Products

This Appendix C contains important products related to customer care, accounting, charging, and billing. This time a twofold geographical structure of (1) Swiss and (2) world-wide product categories is followed.

C.1 Swiss Products

Product:	DBS, PASS, NexusTRACE - Nexus
Areas:	Customer care, accounting, one-stop billing, network security, fault management
Abstract:	Nexus offers an integrated, off-the-shelf product for customer care, billing, and accounting. The accounting and billing process is independent of the pricing models used and allows for modeling virtually any tariff scheme. Furthermore, “billable objects” can be freely defined (e.g., IP address, E.164, NUI) and grouped (e.g., a subnetwork). Reporting and invoicing is customizable and produces invoices or standard billing records (EDI). DBS’ process model is borrowed from the NMF and integrates service and network view. Network technology supported includes: Telephony, Internet (IP), ATM, Frame Relay, X.25. The billing kernel of DBS is fed with accounting records from accounting processors which also comprise non-traffic charges (equipment lease, technical support, etc.) and value-added services (e-mail, voice mail, etc.). For clearing (peering) transfer agreements, DBS also supports the collection of statistical traffic data.
Customers:	Telecoms (Unisource Business Networks Switzerland, Deutsche Telecom), enterprises (Dresdner Bank, Novartis)
Contact:	Nexus Telecom AG Feldbachstrasse Postfach 215 CH-8634 Hombrechtikon, Switzerland E-Mail: info@swiss.nexus-ag.com
Prices:	–

Name:	Econis AG - Econis
Areas:	Electronic Commerce Solutions
Abstract:	Econis is specialized in projects increasing the productivity in sales and marketing processes. Their solutions provide a seamless integration in existing business applications. Econis figures as a system integrator for a wide area of commercial key products. The main focus lies on the integration of workplace-near solutions in the area of workflows and office communication.
Contact:	Econis AG Martin Kündig Business Unit ECA Neumattstrasse 7 CH-8953 Dietikon 1, Switzerland Phone: +41 1 744 73 73 FAX: +41 1 744 73 99 E-Mail: martin.kuendig@econis.com URL: http://www.econis.ch

Name:	NOVAVOX Ltd. - Smartphone
Areas:	Telephony application
Abstract:	Smartphone is a powerful and intuitive telephony application generator for the complete MS-WINDOWS platform. With Windows and an existing phone system, Smartphone creates a broad range of inbound and outbound telephone applications and services such as automated call processing, voice mail with PABX-integration, voice and fax response, automated telemarketing and much more. It’s has been developed for the home office (SOHO) and small to mid range businesses (SME) market in mind, but has the power to satisfy the needs of large corporations as well.
Contact:	NOVAVOX Ltd. Technoparkstrasse 1 CH-8005 Zürich, Switzerland Phone: +41 1 445 75 75 FAX: +41 1 445 75 76 E-Mail: info@novavox.com URL: http://www.novavox.ch

C.2 World-wide Products

Product:	Communications Resource Manager – CRM
Areas:	Customer care, billing strategies, data audits, integration of value added services
Abstract:	CRM is a fully integrated management information and billing system capable of simultaneously supporting cellular, paging, PCS, mobile data, SMR, and CT2 services. CRM enables you to provide a single, individualized customer invoice, separating charges for each service offering. CRM enables you to activate multiple services from a single point and to consolidate customer service. And CRM's various currency and multi-lingual capabilities facilitate tailoring to a country's unique environment. CRM provides complete control over setup and maintenance of all system parameters. Across the product line, CRM is table driven, with straightforward screens and field-sensitive online help. Consulting services include, e.g., Business Start-up Preparation - our experts can start-up and run wireless communications businesses. Business Analysis and Process Definition - our experts will examine your ongoing operations and make constructive suggestions to improve your customer satisfaction and bottom line. Customer Care and Billing - our experts will train your staff and will assist with putting your customers on-line. They will help you run your operations and recognize your revenues. Real time Usage Monitoring - our experts will help you put systems in place to capture your usage revenue stream.
Contact:	Subscriber Computing Inc. 18881 Van Carmen Avenue, Suite 450 Irvine, 92612 California, U.S.A. Phone: +1 714 260 1500 FAX: +1 714 260 1515 E-Mail: – URL: http://www.subscriber.com/p&s.htm

Product:	Subscriber Management and Billing System – Eclipse
Areas:	Retail and Wholesale Billing for Communication Services
Abstract:	Software for subscriber management, billing, provisioning, and other operational support systems for the communications service industry, including retail and wholesale billing for communication services, EDI between service and network providers, and financial systems.
Contact:	DOMUS Software URL: http://www.domus.com/tbs/default.htm

Product:	Lotus Notes/Domino - Lotus
Areas:	Customer care oriented work-flow products
Abstract:	Lotus does not provide off-the-shelf solution, they rather offer a workflow kernel which is customizable and programmable. This basic system is used by several carriers like Sprint and NYNEX. The applications used are custom-developed or provided by consulting and development specialists (Lotus Partners). Third-party developers for Lotus Notes/Domino, do also offer shrink-wrapped solutions for telecommunication companies. A selection includes: 1. Valucom, Inc. offers tariff information systems (http://www.tariffnet.com) 2. Global Compliance, LLC, addresses specific business processes within your Regulatory Affairs and Legal Department. Tariff management is one specific area. 3. Big Sky Technology, Inc. offers complete Notes telephony solutions based on Lotus Phone Notes and customized to your specifications. Access is provided to any Notes database from any touch-tone telephone. Targeted to automated customer care.
Contact:	Lotus Development, Inc. URL: http://www.lotus.com/

Name:	SAP Telecommunications - SAP
Areas:	Customer care oriented work-flow products in the telecommunications
Abstract:	SAP's solution delivers telecommunications business and software expertise to help meeting business and operational challenges. SAP Telecommunications is SAP's industry solution for telecommunications companies of all sizes, with the flexibility of a component-based software architecture that allows the companies to tailor the system to meet their individual needs. SAP Telecommunications software components integrate the telecommunications companies' processes from network provisioning, service and revenue management, marketing, purchasing, and personnel management to financial and cost accounting. This allows for more responsive customer service, easier information access and enhanced operational efficiency. SAP Telecommunications is built on SAP's Business Framework architecture, integrating telcos industry functionality with R/3's enterprise business process and information management tools, rich multicompany and multinational functionality (including multilingual and multicurrency conversion), business workflow technology, and Internet/intranet-enabled applications. The integrated solution provides the solid infrastructure and functionality for telcos to better manage their businesses today and the flexibility to grow and succeed in a future of global change.
Contact:	SAP AG, Waldorf URL: http://www.sap.com/products/industry/tele/teletoc.htm

Name:	Lucent Technologies Internet Call Center - Lucent ICC
Areas:	Call center management technology linked to the Internet Customer care oriented work-flow products in the telecommunications
Abstract:	Internet Call Center offers significant capabilities that allow businesses to take customer care to a higher level. First is the ability to deliver a complete, uninterrupted Web voice/data experience over a single, regular phone line.Current Internet-based call center products require the customer to have a second line or a high-speed circuit for uninterrupted Web voice/data service. A Web customer without this extra facility must disconnect the Web session to free the line and wait for a callback from a live agent. Secondly, the Internet Call Center allows an agent to “lead” the customer on a tour of the Web pages based on input from the customer. The agent selects the pages from the business Web site and “loads” the pages on the customer's PC. This capability improves agent efficiency and aids the agent in “closing the sale” and/or completing the call.
Contact:	Lucent Technologies URL: http://www.lucent.com/BusinessWorks/callcenter/brochures/icc_page.html

Name:	LHS Intelligent Call Center and Business Support and Control System-ICC/BSCS
Areas:	Call center management technology, charging and billing for cellular networks
Abstract:	ICC is a sophisticated automatic call distribution system with out-bound call capabilities. ICC has computer telephony integration capabilities to combine intelligent call handling with customer based applications such as BSCS. This allows ICC to deliver a simple and efficient system to streamline business operations, increase productivity, improve service quality, and enhance customer satisfaction. The ICC application consists of a series of voice/data modules that can be integrated to suit the users' requirements BSCS offers charging and billing functionality for a wide range of cellular phone systems. It is customizable to different pricing structures, languages, and other national requirements.
Contact:	LHS Group URL: http://www.lhsgroup.com

Name:	Kenan Systems' Arbor/BP
Areas:	Call center management technology linked to the Internet customer care oriented work-flow products in telecommunications
Abstract:	Kenan's Arbor/BP is a stable and full-featured product solution. Arbor/BP is highly flexible and configurable with support for multiple languages, currencies, discount plans and bill formats. The result is a product that combines the rapid time-to-market and cost effectiveness of a product solution with the flexibility of a custom solution. Arbor/BP's object-oriented data model and table-driven billing processes are easy-to-use and extremely flexible. Arbor/BP allows service providers to independently configure and extend Arbor/BP to support their changing business rules, minimizing cost and time to market for new initiatives. It leverages a multi-server architecture and powerful SMP UNIX machines to provide a highly scalable solution. Arbor/BP can grow with the needs of the service provider and provides mainframe performance without mainframe costs by distributing storage requirements and processor load over several servers. Arbor/BP's open systems architecture and documented APIs ensure seamless integration with existing systems infrastructure. The intuitive customer care graphical user interface (GUI) enables customer service representatives (CSRs) to respond to customer inquiries and provide superior customer service. Arbor/BP also features iCARE, an HTML user interface for Internet-based customer self-care.
Contact:	Kenan Systems' Arbor/BP URL: http://www.kenan.com/arborbp/overview.htm

Name:	Calico Technology
Areas:	Electronic Commerce Solutions
Abstract:	Calico Technology, Inc., located in San Jose, is a leading provider of Electronic Commerce software and professional services that enable the interactive buying and/or selling of complex products and services across a variety of platforms. Calico develops and markets software solutions designed to allow sales organizations, customers, and end users to analyze requirements, access marketing data, configure solutions, develop quotations, generate proposals, and place orders using the Internet, intranet, laptop computers and CD-ROMs. Calico's software and services allow customers to increase their competitive advantage at the point of sale and to expand channels of distribution, reduce costs, increase customer satisfaction, and build brand.
Contact:	Calico and alliance partners (e.g. Econis AG) URL: http://www.calicotech.com

Name:	Clarify
Areas:	Customer Service Solutions
Abstract:	Once a prospect becomes a customer, Clarify's customer service solution helps proactively manage the accounts. It gives a global view of the activities, inquiries, service requests and problem reports across the entire account base information needed to improve customer satisfaction and retention. Users can collaborate with team members to efficiently manage customer service requests, while Clarify's workflow engine ensures those requests are handled with bulletproof accountability. That accountability can even be extended to service partners using Clarify's extended enterprise technology to give customers and service partners direct access to the company's knowledge base over the World Wide Web. An integrated problem resolution system allows product knowledge to be shared throughout the company and leads support representatives through the diagnostic process to quickly solve customer problems. Clarify's Customer Service applications include customer support, telecommunications customer and trouble management, Web support and Web full-text search, account management, and problem resolution
Contact:	Clarify and alliance partners (e.g. Econis AG) URL: http://www.clarify.com

D. List of Abbreviations

The following list of abbreviations covers the main sections of this pre-study to allow for a unique determination of utilized acronyms.

ABR	Available Bit Rate
ACD	Automatic Call Distribution
ACTS	Advanced Communication Technologies and Services
ANSI	American National Institute for Standardization
AOL	American On-line
ATM	Asynchronous Transfer Mode
ATM-F	ATM Forum
B-ISDN	Broadband–Integrated Services Digital Network
CBR	Constant Bit Rate
CCIC	Competence Center for Information and Communication
CHF	Swiss Francs (Currency)
CIR	Committed Information Rate
CORBA	Common Object Request Broker Architecture
CSR	Customer Service Representative
CTI	Computer Telephone Integration
DES	Digital Encryption Standard
DIS	Digital Interaction Services
ECA	Electronic Commerce Architecture
EDI	Electronic Data Interchange
EIR	Excess Information Rate
ETH	Eidgenössische Technische Hochschule
EU	European Union
ETR	ETSI Technical Report
ETSI	European Telecommunications Standardization Organization
FDDI	Fiber Distributed Data Interface
GUI	Graphical User Interface
GSM	Global System for Mobile Communications
HTML	Hyper-Text Mark-up Language
HTTP	Hyper-Text Transport Protocol
IAP	Internet Access Provider
IBM	International Business Machines Corporation
ICC	Intelligent Call Center
IETF	Internet Engineering Task Force
iKP	Internet Keyed Payment Protocol
intserv	Integrated Services Internet

IP	Internet Protocol
IPng	Internet Protocol Next Generation
ISDN	Broadband–Integrated Services Digital Network
ISO	International Organization for Standardization
ITU-T	International Telecommunications Union – Telecommunications Standardization Sector
ISP	Internet Service Provider
JEPI	Joint Electronic Payment Initiative
KOMBV	Kommunikationsnetz der Bundesverwaltung
LAN	Local Area Network
NMF	Network Management Forum
N-ISDN	Narrowband–Integrated Services Digital Network
OECS	Organization for Economic Co-operation and Development
OSM	Open Service Market
PBX	Private Branch Exchange
POP	Point of Presence
PSTN	Public Switched Telephone Network
PTT	Post Telephone Telegraph (nowadays Telco)
QoS	Quality-of-Service
RADIUS	Remote Authentication Dial-in User Service
RBOG	Regional Bell Operating Companies
rtfm	Real-time Flow Measurement
RSA	Rivest–Shamir-Adleman encryption algorithm
RSVP	Resource Reservation Protocol
SECCO	Support Environment for Electronic Commerce
SET	Secure Electronic Transactions
SDH	Synchronous Digital Hierarchy
SME	Small and Medium Enterprises
SNF	Schweizerischer Nationalfonds
SNMP	Simple Network Management Protocol
SONET	Synchronous Optical Network
SPP	Schwerpunkt Programm
SSL	Secure Socket Layer
S-HTTP	Secure-Hyper-Text Transport Protocol
TCP	Transmission Control Protocol
Telco	Telecommunication Services Provider
TIK	Institut für Technische Informatik und Kommunikationsnetze
TINA	Telecommunications Information Networking Architecture
TMN	Telecommunications Management Network

TV	Television
UBR	Unspecified Bit Rate
UCD	Uniform Call Distributor
VASR	Value Added Service Reseller
VAT	Value-added Tax
VBR	Variable Bit Rate
VCC	Virtual Channel Connection
VoD	Video-on-Demand
VPC	Virtual Path Connection
VPN	Virtual Private Network
WAN	Wide Area Network
WWW	World Wide Web
W3C	World-Wide Web Consortium