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SERIES Q: SWITCHING AND SIGNALLING

Technical Report: Overview of Signalling and Protocol Framework for an Evolving Environment (SPFEE)

ITU-T Q-series Recommendations – Supplement 27

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ITU-T Q-SERIES RECOMMENDATIONS

SWITCHING AND SIGNALLING

SIGNALLING IN THE INTERNATIONAL MANUAL SERVICE	Q.1–Q.3
INTERNATIONAL AUTOMATIC AND SEMI-AUTOMATIC WORKING	Q.4–Q.59
FUNCTIONS AND INFORMATION FLOWS FOR SERVICES IN THE ISDN	Q.60–Q.99
CLAUSES APPLICABLE TO ITU-T STANDARD SYSTEMS	Q.100–Q.119
SPECIFICATIONS OF SIGNALLING SYSTEMS No. 4 AND No. 5	Q.120–Q.249
SPECIFICATIONS OF SIGNALLING SYSTEM No. 6	Q.250–Q.309
SPECIFICATIONS OF SIGNALLING SYSTEM R1	Q.310–Q.399
SPECIFICATIONS OF SIGNALLING SYSTEM R2	Q.400–Q.499
DIGITAL EXCHANGES	Q.500–Q.599
INTERWORKING OF SIGNALLING SYSTEMS	Q.600–Q.699
SPECIFICATIONS OF SIGNALLING SYSTEM No. 7	Q.700–Q.849
DIGITAL SUBSCRIBER SIGNALLING SYSTEM No. 1	Q.850–Q.999
PUBLIC LAND MOBILE NETWORK	Q.1000–Q.1099
INTERWORKING WITH SATELLITE MOBILE SYSTEMS	Q.1100–Q.1199
INTELLIGENT NETWORK	Q.1200–Q.1699
SIGNALLING REQUIREMENTS AND PROTOCOLS FOR IMT-2000	Q.1700–Q.1799
BROADBAND ISDN	Q.2000–Q.2999

For further details, please refer to the list of ITU-T Recommendations.

Supplement 27 to ITU-T Q-series Recommendations

Technical Report: Overview of Signalling and Protocol Framework for an Evolving Environment (SPFEE)

Summary

This Supplement contains objectives, scope, requirements, approaches, and introductory overview of Signalling and Protocol Framework for an Evolving Environment (SPFEE). It provides a signalling and protocol framework for an evolving environment [and related specification(s) where applicable] for those telecommunications-related systems in the coming broadband and information era.

Primary area of SPFEE is Session related framework and specifications (e.g. interfaces provided for "clients" of Session related components and those required from them to the underlying components). SPFEE covers the control plane (signalling) aspects, with management plane aspects also included as a part of the problem domain.

Source

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Keywords

Access, Computational model, IDL, Information model, ODP, Reference Point, Service, Session.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSC Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this publication, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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CONTENTS

Supplement 27 to ITU-T Q-series Recommendations

Technical Report: Overview of Signalling and Protocol Framework for an Evolving Environment (SPFEE)

(Geneva, 1999)

1 Scope

The goal of Signalling and Protocol Framework for an Evolving Environment (SPFEE) is to provide a signalling and protocol framework for an evolving environment [and related specification(s) where applicable] for those telecommunications-related systems in the coming broadband and information era. SPFEE will take the opportunity to incorporate advantages of the latest information technologies, e.g. ODP, for achieving its goal, while keeping interoperability with evolving telecommunications technologies including IN CSx (x = 1,2,3,..), TMN, B-ISDN, IMT-2000, UPT, and Multimedia:

- SPFEE will be based on distributed processing technologies and object orientation.
- SPFEE will use the enterprise, information, and computational viewpoints as defined in Reference Model of Open Distributed Processing (RM-ODP). The enterprise viewpoint needs to be examined for clarifying the requirements.
- It is recognized that there are needs to:
  1) "correlate" SPFEE with other ongoing activities, such as IN CS-3, TMN, and B-ISDN, e.g. to provide evolutionary paths for them; and
  2) interwork with "legacy" systems.
- The ownership of each entity should be generally separated from the technical development of SPFEE, although such aspect may be covered by referring some example configuration scenarios.
- Primary area of SPFEE is Session related framework and specifications (e.g. interfaces provided for "clients" of Session related components and those required from them to the underlying components). SPFEE covers the control plane (signalling) aspects, with management plane aspects also included as a part of the problem domain.
- A part of final outputs from SPFEE will be specifications of objects (and their interfaces) in formal specification languages, e.g. IDL and ODL.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Supplement. At the time of publication, the editions indicated were valid. All supplements and other references are subject to revision; all users of this Supplement are therefore encouraged to investigate the possibility of applying the most recent edition of the supplements and other references listed below. A list of the currently valid ITU-T Recommendations and supplements is regularly published.

[1] ITU-T Recommendation X.901 (1997) | ISO/IEC 10746-1:1998, *Information technology – Open distributed processing – Reference Model: Overview*.

[2] ITU-T Recommendation X.902 (1995) | ISO/IEC 10746-2:1996, *Information technology – Open distributed processing – Reference Model: Foundations*.

[3] ITU-T Recommendation X.903 (1995) | ISO/IEC 10746-3:1996, *Information technology – Open distributed processing – Reference Model: Architecture*.

[4] ITU-T Recommendation X.920 (1997) | ISO/IEC 14750:1999, *Information technology – Open distributed processing – Interface definition language*.

[5] ITU-T Recommendation Z.130 (1999), *ITU Object definition language*.

[6] ITU-T Q-series Recommendations – Supplement 28 (1999), *Signalling and Protocol Framework for an Evolving Environment (SPFEE) specifications for service access*.

3 Definitions

This Supplement defines the following terms:

3.1 business administrative domain: A business administrative domain is defined by the requirements of one or more business roles and is governed by a single business objective.

3.2 business relationship: An association between two business roles.

3.3 business role: The expected function performed by a stakeholder in a telecommunications business environment.

3.4 contract: A contract is the context defining constrains for one or more reference points to operate under.

3.5 reference point: The manifestation of a business relationship in the telecommunication system. The reference point consists of several viewpoint related specifications governed by a contract.

3.6 stakeholder: A party that holds a business interest or concern in the telecommunications business. A stakeholder owns one or more business administrative domains.

3.7 session: A temporary relationship among a group of objects that are assigned to collectively fulfill a task for a period of time. A session has a state that may change during its lifetime. The session represents an abstract, simplified view of the management and usage of the objects and their shared information.

3.8 access session: A temporary relationship established when two domains are bound together securely. The early stage of the access session is the agreement of terms between domains to continue interaction and authentication. Security protection may be delegated to subsequent service sessions.

3.9 service session: A temporary relationship represented by information and functionality related to capabilities to execute, control and manage services. The capabilities include service specific control, generic session controls, and management capabilities. A service session is an instance of a service type and includes information necessary to negotiate QoS, security context, use of service and communication resources, and to control relationships among participating members of the service session.

3.10 communication session (resource): A temporary relationship represented by a general, service view of stream connections and a network technology-independent view of the communication resources required to establish end-to-end connections. A communication session can handle multiple connections that may be multipoint and multimedia.

4 Abbreviations

This Supplement uses the following abbreviations:

3Pty	Third-party inter-domain reference point
anonUA	Anonymous User Agent
AS	Access Session
as-UAP	User Application (Access Session related)
Bkr	Broker inter-domain reference point
CO	Computational Object
COG	Computational Object Group
ConS	Connectivity Service inter-domain reference point
CS	Communication Session
CSLN	Client-server layer inter-domain reference point
DPE	Distributed Processing Environment
FCAPS	Fault, Configuration, Accounting, Performance, Security
IA	Initial Agent
IDL	Interface Definition Language
LNFed	Layer network Federation inter-domain reference point
NamedUA	Named User Agent
ODL	Object Definition Language
ODP	Open Distributed Processing
OMT	Object Modelling Technique
PA	Provider Agent
Ret	Retailer inter-domain reference point
RP	Reference point
RtR	Retailer-to-Retailer inter-domain reference point
SC	Service Component
SF	Service Factory
SPFEE	Signalling and Protocol Framework for an Evolving Environment
SS	Service Session
SSM	Service Session Manager
ss-UAP	User Application (Service Session related)
Tcon	Terminal Connection inter-domain reference point
UA	User Agent
UAP	User Application
USM	User Service Session Manager

5 Requirements

5.1 Business Drivers

Major business drivers that lead to the requirements described in this Supplement include:

- interconnection among various types of networks/servers;
- advances within broadband networks and services;
- Internet and on-line services;
- mobile communications;
- ubiquitous user access to services;
- support both standard and non-standard services;
- interworkable open interfaces with existing ISDN, PSTN, etc.

5.2 Trends toward the telecommunications environment, year 2000+

"The difficulty lies, not in the new ideas, but in escaping from the old ones, which ramify, for those brought up as most of us have been, into every corner of our minds." (British economist John Maynard Keynes, circa 1925.)

5.2.1 Introduction

There is a fundamental and rapid shift taking place in the telecommunications sector throughout the world:

- The shift from monopoly supply to an open competitive market in services and equipment. This leads to a medium term need for the regulation to encourage competition and measures to ensure effective and fair interconnection.
- The shift from a network/technology based platform to a software/marketing based platform.
- The shift from separate industries for communications, IT and broadcasting to convergence through the integration of services and operations.
- The shift from national to regional (e.g. European) and then to global approaches concerning services, as well as the principles for regulation.
- The shift from proprietary technologies and solutions to increased emphasis on standards to facilitate multi-vendor solutions, inter-operability and support the open competitive market.

Enormous complexities and rapid technological evolutions in the four key digital communications technologies (radio, software, opto-electronics, and semiconductors) have meant that decisions to purchase systems and services is no longer based purely on technology. The main reasons for this are the scarcity of the required expertise to differentiate between competing technologies and the need to generate return on investments for the shareholders. Moreover, many new entrants (service providers, re-sellers, etc.) do not even own their network(s). Thus the shift to the ultimate end-user product differentiation via a software/marketing platform – the second piece of the jigsaw puzzle.

End users are calling for simplicity in service provisioning. Falling costs of digital processing are leading to cheap information appliances – computers, televisions, "smart" telephones and combinations thereof – plugging into a ubiquitous "multimedia information" network. Such factors have created an environment where "packaged" applications obtainable from a single source (the vendor) become an economic necessity. Thus, as monopolies crumble and industrial convergence is legally possible, telecommunications is gradually developing the wholesale/retail characteristic seen in other industries – the third piece of the jigsaw puzzle.

Estimates of the costs for upgrading existing communications infrastructures globally to provide advanced value-added services are astronomical (over US$ 1000 Billion – FT 7/12/95). In order for

the private sector to be willing to make the required investments, the regulatory regime, global trade policies, and the sheer commercial potential have all to be right – the remaining pieces of the jigsaw puzzle.

However, the use and production of conformance testing standards is expected to continue, as required, between purchasers and their suppliers. It is expected that the legal requirements will be relaxed, as conformance to standards will become a guarantee of quality rather than a legal or national mandatory requirement. The general use of conformance testing standards for all standard interfaces will continue to be questioned and such scenarios will be developed on the basis of openness of interfaces and priorities for resale.

5.2.2 Customer trends by the year 2000+

Customer demands are closely related to the social environment in which the individual resides. As each country has its unique lifestyle one would expect a huge variety of trends within the global community. Fortunately, some trends seem to be shared by different societies belonging to the group of industrialized countries and may well serve as a basis for some predictions of customer demand in the telecommunications market.

5.2.2.1 Common trends in industrialized countries

The "megatrend" is individualization. People are becoming more and more aware of their individual rights, demands, wishes, etc.

Perhaps the most important consequence of the trend to individualization is the increasing demand for mobility; this is probably the most typical way of expressing individuality. Where physical mobility might not be possible for one reason or another, substitutes such as telecommunications are used. Personal mobility and its substitutes minimize differences between societies and widen the scope of the individual to the global context.

People are increasingly concerned about their health and are willing to accept restrictions to their personal lifestyle in order to gain fitness and well-being. The wish for personal security is also gaining importance in a fast developing world and goes well beyond demands for personal safety of the body or protected property: in the customer's view, even thoughts and ideas need to be protected.

While individuals are aware that environmental developments can cause problems for the community at large they are often prepared to accept this impact if their individual lifestyle benefits. This ambivalence can encourage the growth of extremism in environmental movements.

Significant demographic changes seem to follow industrialization. Increased longevity can be observed in almost all societies belonging to the group of industrialized countries. Birth rates are continuously going down but at the same time medical improvements lead to an increased life expectancy. In many countries older people constitute a significant buying power, leading to an increased self-assertion among this group.

Trustworthiness is gaining importance as a reaction to the increasing complexity of the world. Only a few customers really anticipate all dimensions of the products they purchase. In order to be confident of the products they buy and to be convinced of their harmlessness, people tend to rely upon the seller of the products. The logic is something like: "If I know who is selling me this product and I trust that person, I feel confident that the product is good for me".

We all are dependent on work, on jobs. Historically speaking this dependency is quite young. Global markets will change peoples' attitude towards work dramatically. The cosy job in the office will be a thing of the past, replaced by a "virtualized" working environment. This new work will be characterized by a new independence from the company where people are acting as entrepreneurs even within "their" company. Loosening of the strict contractual relation between companies and employees will automatically loosen the relation between the individual and his "workplace". Work will be performed anywhere that is convenient.

The foregoing has provided some typical examples of trends in industrialized countries. It is far from being a comprehensive catalogue of common developments but helps to derive the following list of future demands in the telecommunications market.

5.2.2.2 Future demands of customers in the field of telecommunications

Taking the trends mentioned above, the demands of the telecommunications customer of the future are likely to include:

a) individualized products at mass market price-level;

b) specialized products for particular age groups;

c) high quality products (value for money);

d) presentation of non-voice information in accordance with human perception (sound, picture => Multimedia);

e) trustworthiness;

f) secure use of the products (no harm to persons or the environment, no fraud or violation of privacy);

g) ease of use, self-explanatory product handling;

h) support (or at least not restriction) of personal mobility;

i) manageable reachability at different places by use of different products;

j) support for the individual security of the user (e.g. emergency calls);

k) support of mobile teleworking.

These attributes are not ranked by importance as they may be found with varying intensity in different environments. Very broad variations of demand may arise, even in small groups of customers. Facing the global market, the complexity of the demands is leading to a situation where the extreme may be described by the catchphrase of the "Mass Market of One" where an individual can obtain personalized products and services under mass market conditions.

5.2.2.3 Demands for telecommunications in other countries

As mentioned above, the trends and derived product attributes are really only valid for industrialized countries. Nevertheless, telecommunications and information technology are regarded as outstanding strategic fields for development in all the world's societies. It can be concluded that in order to achieve a truly global market, strategies will be applied that ensure an adequate supply of telecommunications services. Nothing less than the latest technologies and services will be accepted. Thus, even if the social driving forces are different from those in today's industrialized countries, it can be expected that most other countries will be making similar calls for a wide variety of networks and services. As timing and deployment cost are crucial in this development, wireless services are attractive as a substitute for wireline technologies and services, and will be applied on a broad basis.

5.2.3 Network trends

During the 1990s telecommunications networks have become ever more diverse and complex. Fixed telephone network facilities have been extended by the introduction of ISDN and now Broadband capabilities are also being introduced. A variety of different mobile networks have been developed to meet different market needs for mobility, the best known being GSM. Cordless access systems such as DECT can be used in private networks (e.g. Local Area Networks) and can be attached to both fixed and cellular networks.

There are other network trends such as the rapid introduction of Cable TV networks and network broadcast capabilities. Satellite systems will be used for personal communications services (e.g. INMARSAT Project 21) and the distinction between private and public networks is becoming more blurred with the introduction of Virtual Private Networks (VPNs) into the public environment.

For the introduction of multimedia services, one of the most important trends is probably the extremely rapid acceptance of Internet. Its difference from traditional telecommunications networks in respects such as tarriffing, architecture and technology is significant.

Thus, at present there are different types of service network. Certain technological developments are not restricted to only one network type. Some operators are bringing about a convergence between fixed and mobile networks, with both network types providing similar kinds of network services. Hence in the future, IN based services may be used to provide mobility in fixed networks as well as being the key to additional services in mobile networks. Customers will access their personal profiles via a terminal using (for instance) a Smart Card; their personal profiles will define their identity and the range of services they are entitled to use, as well as details of their billing arrangements.

In the future the network operator will not necessarily be the same organization as that which acts as the service provider. The ITU definition of "Service Provider" should not be confused with today's service provider who is often a commercial subsidiary of the network operator/PTT.

Service providers providing a "One Stop" service to customers can act independently of the operator. However, interfaces with those bodies should be available through appropriate telecommunications interfaces (e.g. charging, registering etc.).

Finally, network trends will be significantly affected by the emergence of demands on the Information Infrastructures. In ITU, the concept is the Global Information Infrastructure (GII) is under study. Networks supporting the GII will have to be defined using world benchmarks and meet world class standards in terms of responsiveness, quality, cost, time to market: they should also be able to support entry into, and the creation of, new markets for new services applications.

5.2.4 Technological trends

The evolution of mobile and personal communication will be heavily influenced by technological trends, since new and advanced technologies will allow the realization of innovative system concepts. Several technological areas identified below are relevant for fixed, mobile and personal communication systems:

- Digital Radio Access;
- Fixed Access Network Technology;
- Data compression technology;
- Antenna technology;
- Satellite technology;
- Communication technology;
- Opto electronics;
- CPU technology;
- Memory technology;
- Disk and memory card technology;
- Display technology;
- Smart card technology;
- Efficient energy management;
- Software technology;
- Portable Object Distributed Software;
- Interactive user interfaces.

5.2.5 The role of standardization

Telecommunications standards are required for a variety of reasons. The original reason for negotiating standards was to enable the interconnection of international networks. Since then other factors have developed such as the desire for harmonized networks and for cost reduction based on economies of scale.

5.2.6 Strategic issues for standardization

Each of the key technologies identified above can be expected to evolve at a different speed. This will lead to a diversity of networks supporting differing network capabilities. Network capability trade-offs and radio access characteristics and capabilities (cell coverage area, bit error rate, delay characteristics, etc.) will all influence which services and applications are supported in global mobile multimedia via the access networks.

One important issue for global mobile multimedia standardization relates to the optimum use of the scarce radio frequency resource, which is likely to be a significant limiting factor in the deployment of global mobile multimedia services and applications. Hence, technologies and standards have to be developed so as to maximize the utilization of the limited spectrum, taking due account of the Quality of Service expectations of the global mobile multimedia end user.

In addition to these critical points, a series of more general issues has to be faced to allow a graceful deployment of global mobile multimedia in a fully competitive environment.

5.2.6.1 Strategic goals

Given the trends identified in previous sections, the principal strategic goal must be to produce "enabling" standards which allow the provision of services and applications that appeal to the market (demand oriented products), as well as those personalized to a user's particular needs (mass market prices for individual requirements). These services and applications should be provided from different access/transport infrastructures in a ubiquitous manner so that the user is presented a seamless environment for customized services and applications while on the move.

From this primary goal, one can derive secondary goals which allow greater freedom and competition at the services and applications layer. The opportunities presented to communications service providers will permit them to further develop their business as basic core transmission becomes a commodity item, thus allowing them to move up the value chain.

As has already been identified, the services and applications standards must also be open enough to provide opportunities for content and information service providers to develop their business such that they can operate at a global level.

Finally, given the need for global solutions, the standards have to be attractive enough to be adopted not only in the regions (e.g. Regional, Fora and *de facto*) so that products, services and applications developed using ITU and ISO standards can be used worldwide.

5.2.6.2 Means to achieve the goals

A challenge is how to evolve from a diversity of standards and solutions into a consistent set which meet the strategic objectives described above. A clear view of future is needed, in which seemingly contradictory options can be combined. This means that standards will need to be developed which allow interworking regimes to interconnect domains (user/terminal domains connected to application/service domains via access network and core transport network domains) using specific standardized interfaces.

In particular, the standards need to address large markets in a timely manner and to provide for:

- enough commonality to be able to be used in different "systems";
- efficient use of human, financial, radio spectrum and other resources;

- backwards compatibility to allow smooth evolution; and
- inter-system connectivity and roaming.

5.2.6.3 Requirements for an open standards framework

It is clear that no one system can economically offer the full range of global mobile multimedia services and applications since a lot of different economic players will be involved in providing them, using multiple networks made up of different network elements.

Since the strategic goal in this competitive environment is to facilitate the market led development of services through choice in the marketplace, rather than *a priori* assessment of market needs, and since many different economic players will be involved in the provision of the global mobile multimedia services and applications based on diverse combinations of functional elements, an open and modular framework of standards should be developed.

In order to keep up with the pace required by market forces it will probably be necessary to follow a standardization route which allows for independent development of networks offering different kinds of service applications. Technical integration will lead to less competitiveness and longer lead times.

The issue of integration or differentiation can vary according to each different situation and should be resolved by market forces. Standards therefore need to be developed in such a way that networks can be built to offer integrated as well as differentiated service applications as required.

In conclusion, the standardization framework should:

- facilitate innovation in technology;
- allow "product" differentiation of bearer services and application services;
- allow competition between different elements (i.e. it should allow more than one solution);
- facilitate rapid and cheap testing of services and applications; and
- avoid unnecessary fragmentation by clear specifications of "critical" interfaces between modules.

5.2.6.4 The role of standardization

Telecommunications standards are required for a variety of reasons. The original reason for negotiating standards was to enable the interconnection of international networks. Since then, other factors have developed such as the desire for harmonized networks and for cost reduction based on economies of scale.

5.2.6.5 Modern trends in the use of technical standards

More recently standards have been used to increase competition; the existence of standards enables network operators and service providers to use multi-vendor solutions. The benefits of a multi-vendor environment can be obtained either by using proprietary (or de facto) standards under license or by using agreed national or international standards. These days most standards being adopted are at least European wide, if not Global, so as to take advantage of economies of scale.

For *successful* standards, a balance is required in the *level* of standardization between:

- standards which are so detailed that they inhibit innovation (e.g. for individual product feature development and to retain competitive differentiators);
- standards which are not full enough, or precise enough, to enable a multi-vendor environment to be established.

Another important role for technical standards is to prevent market fragmentation. In some cases only a unified approach to the market can create the conditions of confidence and stability for success: Fragmenting this kind of market can lead to its total destruction which is what happened in

the case of Telepoint services which were initially offered without a Common Air Interface (CAI) standard.

5.3 Requirements

Through the analysis in 5.2, the following requirements have been derived:

1) **Support of a wide range of services**: SPFEE has to support telecommunication, management and information services and should be open to allow the introduction of new classes of services. SPFEE addresses the evolution of services, and should be able to support new requirements and business needs.

2) **Rapid service development and provisioning**: SPFEE must support the rapid development and deployment of services in order to respond promptly to market needs, and at the same time, to reduce development costs. Accordingly, a common approach for the design and management of all kinds of services is required in order to maximize the reuse of service components.

3) **Tailored services**: Services supported by SPFEE must be readily customizable in order to satisfy specific requirements of a variety of customers (ranging from large companies to residential users). Service subscribers and end-users should be offered some direct control in managing their services.

4) **Independent evolution of services and network infrastructure**: Services should be defined independently from a specific network technology. Conversely, the exploitation of new technology should be made easier by the flexibility of SPFEE.

5) **Support for a multi-player (or open) environment**: SPFEE should fit in a multi-supplier/provider/operator environment. The coexistence of a number of stakeholders, performing various business roles, must be supported. In addition, SPFEE must define a flexible framework with respect to changes imposed by regulatory bodies. Accordingly, SPFEE must define an open environment which enables the introduction and modification of services, the introduction and modification of software and hardware components from different vendors and organizations, and the interoperability among such services and components.

6) **Service manageability**: SPFEE must enable the management of services and the service infrastructure, and must facilitate the integration of control and management aspects of services. It fosters the definition of a common software infrastructure and related models that support service control and management applications in a similar fashion.

7) **Universal service access**: End-users must be able to access services independently from the physical location and the types of terminals being used. In addition, services must be accessible and usable in a standard and uniform way with respect to the user practice.

8) **Integration of existing systems and services**: SPFEE should allow for inter-working with existing systems and services, e.g. with Intelligent Network (IN), Telecommunications Management Network (TMN) or WorldWide Web (WWW) based services.

5.4 Objectives

The above requirements determine the objectives that SPFEE should accomplish:

1) Definition of a set of reusable and interoperable service components to be composed in service definition and construction. They guarantee low time-to-market for services and interoperability of service software.

2) Definition of a framework for SPFEE reference points related to services. This ensures interoperability between multi-vendor products, as well as among several stakeholders.

3) Definition of principles and mechanisms that allow systems and services to work together in a seamless fashion (portability of services across domains), even though these systems and services may be in different administrative domains (federation among business roles).

4) Definition of principles and mechanisms that give more effective support in the network to multimedia communications considering multimedia and multiparty aspects of services.

5) Definition of a granular and flexible session model that can evolve to serve the needs over time of different customer bases. This aspect of a telecommunication architecture may be important in:

- allowing a large degree of customization of services;
- enabling quick response of service providers (i.e. retailers and 3rd party service providers) to new customer needs or to new advances in customer equipment.

6) Definition of principles and mechanisms in order to guarantee the smooth service extension.

7) Definition of customizable interfaces and support to different levels of customization, which can be classified into several categories:

- customization of pre-choices/pre-conditions on access to other stakeholders;
- customization of the usage of services;
- customization of configuration of user-system related resources.

8) Definition of partition and layering principles leading to the separation of services from the network and computing infrastructure and related resources.

9) Definition of interfaces providing an abstract view of the network and computing infrastructure that enable service applications to make use of network and computing resources transparently.

10) Definition of principles and mechanisms that allow third-party development of services and applications.

11) Definition of principles and mechanisms for supporting different stakeholders assuming their business roles, i.e. consumer, retailer, broker, third-party service provider, content provider, connectivity provider.

12) Definition of service management functions:

- identification of service components that are to be managed;
- determination of aspects of the components that are to be managed, i.e. functional areas, life-cycle, etc;
- definition of mapping from the identified management functionality to a set of management interfaces that all service software should provide for its management.

13) Definition of mechanisms for customer access to management services.

14) Definition of mechanisms for service composition, both statically (i.e. during design and construction) and dynamically (i.e. during the service utilization).

15) Definition of principles and mechanisms for global mobility, such as support of personal and service session mobility. Personal mobility means the ability for a person to access and use services ubiquitously, i.e. independently of both physical location and specific equipment. Service session mobility means the ability to suspend the use of a service and resume it from a different terminal equipment.

16) Definition of principles and mechanisms enabling the ubiquitous information access, i.e. access to information independently of the location of both the information and the accessing party.

17) Definition of principles and mechanisms to support service availability, security, reliability and performance.

6 Overview of methodology

As defined in Rec. ITU-T X.901 | ISO/IEC 10746-1, a viewpoint (on a system) is an abstraction that yields a specification of the whole system related to a particular set of concerns. Five viewpoints have been chosen to be both simple and complete, covering all the domains of architectural design:

- the enterprise viewpoint, which is concerned with the purpose, scope and policies governing the activities of the specified system within the organization of which it is a part;
- the information viewpoint, concerned with the kinds of information handled by the system and constraints on the use and interpretation of that information;
- the computational viewpoint, which is concerned with the functional decomposition of the system into a set of objects that interact at interfaces – enabling system distribution;
- the engineering viewpoint, which is concerned with the infrastructure required to support system distribution;
- the technology viewpoint, which is concerned with the choice of technology to support system distribution.

For each viewpoint there is an associated viewpoint language which can be used to express a specification of the system from that viewpoint. The object modelling concepts give a common basis for the viewpoint languages and make it possible to identify relationships between the different viewpoint specifications and to assert correspondences between the representations of the system in different viewpoints.

The enterprise language introduces basic concepts necessary to represent an ODP system in the context of the enterprise in which it operates. The aim of an enterprise specification is to express the objectives and policy constraints on the system of interest.

The individual components of a distributed system must share a common understanding of the information they communicate when they interact, or the system will not behave as expected. To ensure that the interpretation is consistent, the information language defines concepts for the specification of the meaning of information stored within, and manipulated by an ODP system, independently of the way the information processing functions themselves are to be implemented.

The computational viewpoint is directly concerned with the distribution of processing but not with the interaction mechanisms that enable distribution to occur. The computational specification decomposes the system into objects performing individual functions and interacting at well-defined interfaces. It thus provides the basis for decisions on how to distribute the jobs to be done, because interfaces can be located independently, assuming communications mechanisms can be defined in the engineering specification to support the behaviour at those interfaces.

The engineering language focuses on the way object interaction is achieved and on the resources needed to do so. It defines concepts for describing the infrastructure required to support selective distribution transparent interactions between objects, and rules for structuring communication channels between objects and for structuring system for the purposes of resource management.

The technology specification describes the implementation of the ODP system in terms of a configuration of technology objects representing the hardware and software components of the implementation.

7 Business Modeling Concepts – A Framework for the propagation of Requirements in an Open Telecommunication Market

7.1 Scope

The business modelling concepts provide the means to model telecommunication and information services in a multi-stakeholder business environment.

The business modelling concepts specify:

- A common business framework for all stakeholders in an open telecommunication market.
- A set of business roles (see 7.3) and business relationships (see 7.4) to enable the construction of a business model for the provisioning of any telecommunication or information service.

A business model which is constructed using the business modelling concepts of this framework shall use the identified business roles and business relationships identified and described in 7.3 and 7.4.

The business model for a particular service is an instantiation of the abstract business model as briefly described in Appendix II.

The instantiation of the abstract business model for a particular service enables:

- the identification of the business roles needed to provide a particular service;
- the association of the business roles with the involved stakeholders;
- the identification of the business relationships between the business roles and the business administrative domains owned by the stakeholders involved;
- the specification of the reference points implementing the business relationships.

In addition, examples of the application of the business modelling concepts are given in Appendix II. They depict the use of business roles and reference points in various "real-life" situations. This provides a means to understand the application of the business modelling concepts, and highlights some typical application situations that might not be obvious from the definitions.

7.2 Business Modelling Concepts

7.2.1 Framework

The basis of an open telecommunication system is the information, computational and engineering objects owned by business administrative domains and separated by reference points. In order to specify the policies and interactions between business administrative domains, one needs to specify the visibility and rights on each type of object in the domain with regard to related domains. These rights and visibility are included in a contract. The contract is established between business administrative domains and can be negotiated.

7.2.1.1 Contract

A contract provides the basis for the contexts defined in the supported viewpoints. Within the constraints specified in the contract, the contexts in the supported viewpoints can be modified by negotiation. However, the contract can never be modified as a result of the negotiations within the supported viewpoints, since a single viewpoint only provides a partial view of the interactions between the business administrative domains and might violate the policies negotiated for the other viewpoints.

7.2.1.2 Business administrative domain

A business administrative domain is defined by the requirements of one or more business roles. Business administrative domains interact with each other through reference points, which are the implementations of the business relationships between business administrative domains.

The concept of business administrative domain is based on ownership. Ownership implies the universal privilege of managing the entities inside the domain.

7.2.1.3 Business roles and business relationships

The business roles are identified by analyzing the current and expected future business needs in telecommunication and information services. The definition of the business roles are driven by the following types of business separations:

- **Technical**: Areas of different development speed of technology are placed in different business roles.
- **Economic**: Business roles which are considered consumers and producers of services in today's information market are assigned to different business roles.
- **Regulatory**: Due to regulatory constraints certain separations of business roles are induced.

All business roles play the role of user and provider towards specific other business roles. Whether a provider or user role is played is determined by the contract governing the interaction between the business roles.

Business roles can be combined in business administrative domains to suit the needs of the stakeholder for its particular business.

A business relationship expresses the interaction requirements between two business roles. The manifestation of a business relationship between two business administrative domains is the reference point.

The initial set of business role types identified is given in 7.3.

The initial set of business relationships identified is given in 7.4.

7.2.1.4 Reference point

The reference point consists of several viewpoint related specifications governed by a contract. A reference point specification is split into reference point segments. Each segment is a meaningful, self-consistent specification.

The reference point is the aggregation of the specifications of all supported viewpoints. The reference point shall contain the following specifications:

- **Business part**: Scope limitations, functional and non-functional requirements posed on the business relationship by the business roles. It is derived from the requirements of the business roles for their interaction.
- **Information part**: Defines the information which is shared between the business administrative domains.
- **Computational part**: Defines interfaces on computational objects to be made accessible to the other domain.
- **Engineering part**: Defines the separations of the supporting distributed infrastructure in nodes, signalling and control links, supporting operating systems and protocol stacks needed for interactions between the business administrative domains.
- **Miscellaneous part**: Defines other constraints, e.g. limitations on other specifications imported into a reference point specification, allowed limitations on compliance, etc.

7.2.2 Segmentation of reference points

A reference point specification is segmented. A reference point segment is a meaningful and consistent cross-section of a reference point specification.

The segmentation into access and usage is driven by the isolation of functionality controlling and managing the business administrative domain interaction (access functionality) from the other functionality providing and managing services (usage functionality).

The generic segments of a reference point are:

- access segment; and
- usage segment.

The reference point segmentation depends on the business relationships that are combined into the reference point and the actual functionality introduced by the business relationships into the reference point. Further segments are possible.

7.2.2.1 Access and usage segmentation

See Figure 7-1.

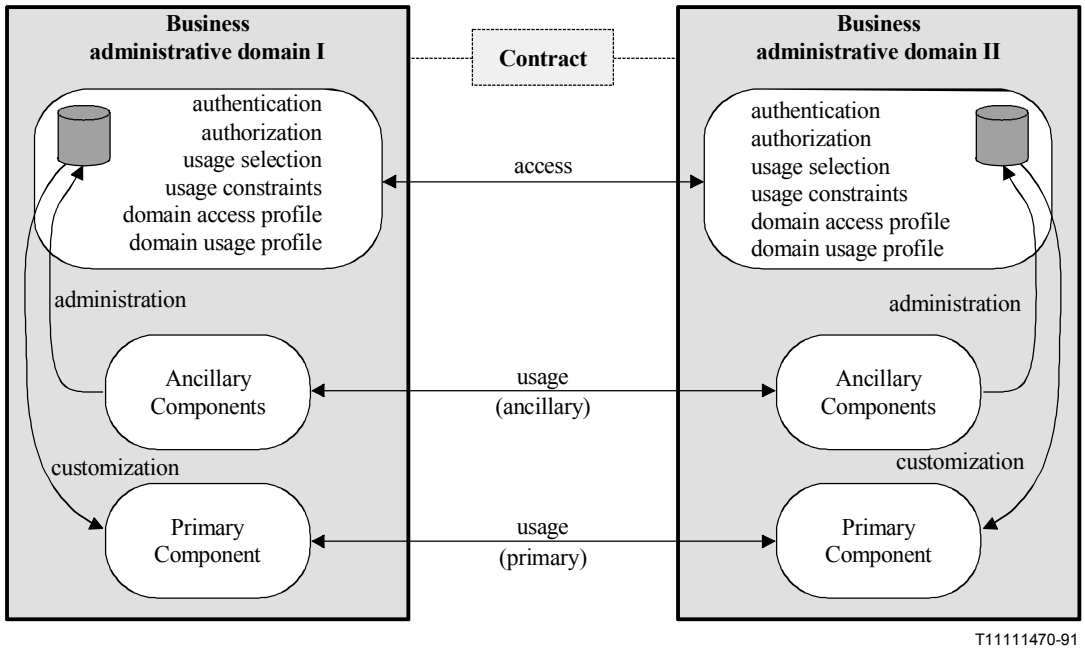

Figure 7-1 – Generic reference point segmentation

The functionality of the Access segment of a reference point is:

- Initiate dialogue between the business administrative domains.
- Identify the business administrative domains to each other[1].
- Establish a secure association between the business administrative domains.

[1] Note that either business administrative domain may remain anonymous dependent on the requested interaction.

- Set up the context for the control and management of usage functionality:
  - the context specifies which services are offered and under which conditions;
  - the context can be changed dynamically over time.
- Initiate the Usage segment of the reference point between the business administrative domains.

The Usage segment is specific to the actual services provided between the business administrative domains. The Usage segment can be further segmented according to:

- the use (direct, e.g. a Video on Demand (VoD) service versus indirect, e.g. fault management for VoD);
- the impact in the domain (e.g. provisioning vs., e.g. management vs., e.g. administration).

The functionalities of the usage segment of a reference point are:

- control of the service life-cycle;
- exchange of service content;
- set and manage the context for a specific service or set of services;
- set and manage the context for domain administration, i.e. functions that are not specific for a single service or a set of services;
- carry out administration functions;
- carry out management functions.

Different versions of business relationships can exist. Each of these different versions is called a profile of the business relationship. A profile is implemented by the reference point.

7.2.3 Combination of business roles into business administrative domains

As shown in Figure 7-2, one or more business roles can be combined into a single business administrative domain which is owned by a single stakeholder.

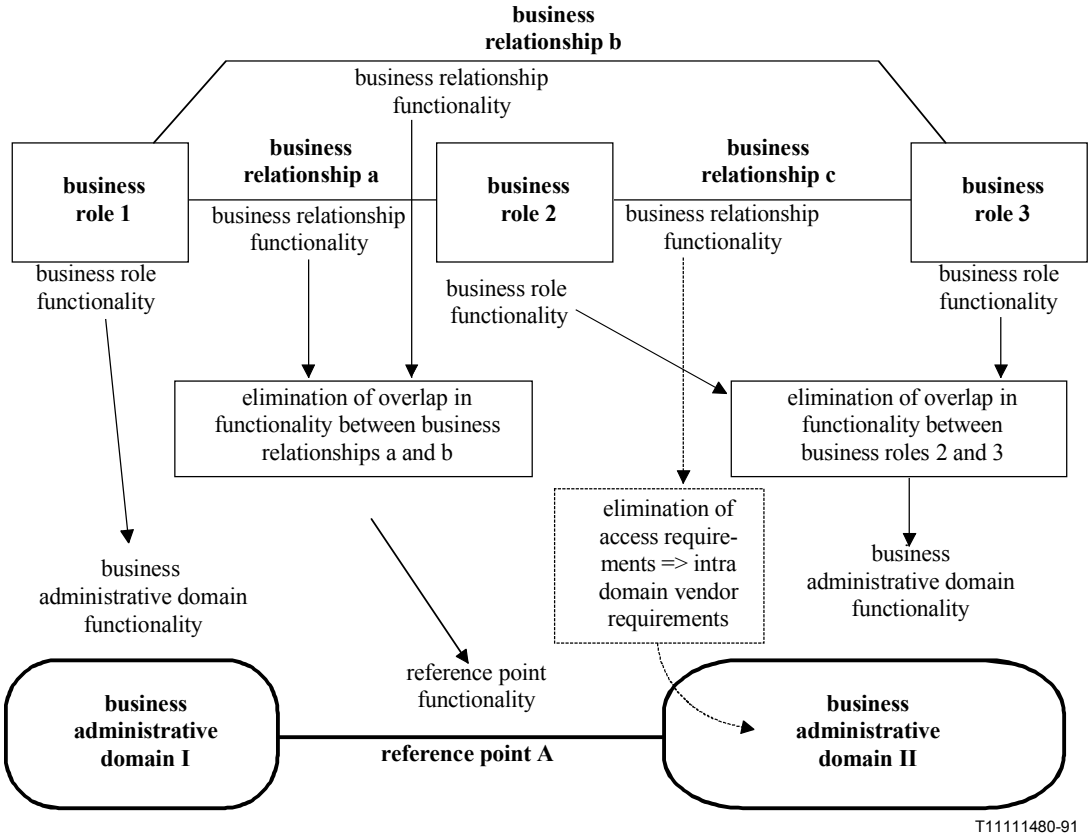

Figure 7-2 – Combination of business roles into business administrative domains

The interactions between business role 1, business role 2 and business role 3 are expressed by the business relationships a (between business roles 1 and 2), b (between business roles 1 and 3) and c (between business roles 2 and 3).

The business role 1 is performed in the business administrative domain I, and the business roles 2 and 3 are performed in the business administrative domain II.

The reference point A, between the business administrative domains I and II is defined as the combined functionality of the business relationships a and b, after the elimination of the overlap in functionality among the business relationships a and b.

Similarly the business administrative domain II performs the combined functions of business roles 2 and 3, after the elimination of the overlap in functionality among the business roles 2 and 3.

The implementation of the business relationship c is not visible outside the business administrative domain II. A reference point that implements the business relationship c is not mandatory. It may still be implemented within the business administrative domain II, in many cases, though by eliminating the access segment, since there would be no need for access control within a single business administrative domain.

7.2.4 Delegation

The segmentation of reference point specifications allows:

- reuse of reference point segments in other reference point specifications; and
- shared functionality between reference points.

This is illustrated between reference point A and B in Figure 7-3 and is called delegation.

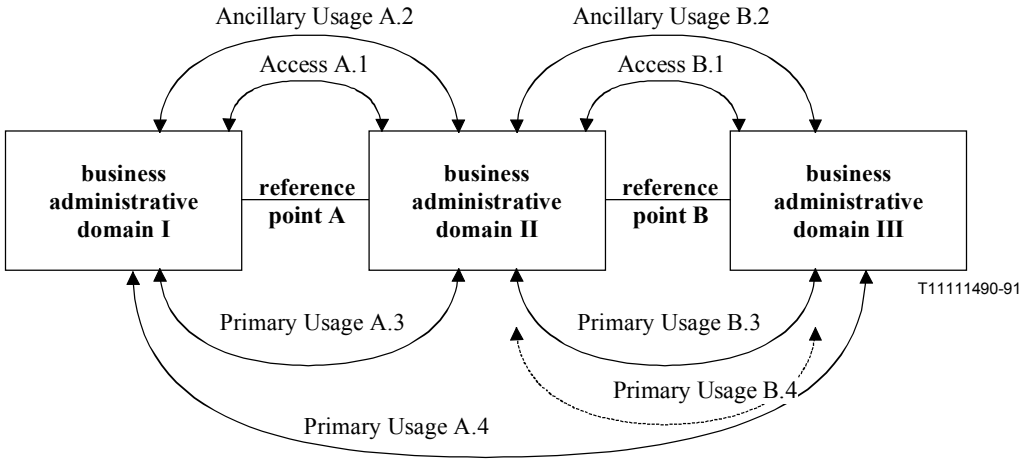

Figure 7-3 – Delegation of reference point segment functionality

Delegation can be static or dynamic:

- Static delegation is used where the delegated segments do not change during the duration of the contract.
- Dynamic delegation is used when the delegated segments may vary over time during the duration of the contract.

Reference point A, between business administrative domain I and II is segmented into:

- Access A.1;
- (Ancillary) Usage A.2;
- (Primary) Usage A.3; and
- (Primary) Usage A.4.

Reference point B, between business administrative domain II and III is segmented into:

- Access B.1;
- (Ancillary) Usage B.2;
- (Primary) Usage B.3; and
- (Primary) Usage B.4.

Business administrative domain II does not add value to reference point segment A.4. Reference point segment B.4, part of the business relationship between business administrative domain II and business administrative domain III, is functionality identical to A.4.

If allowed by the respective contracts between business administrative domains I, II and III the reference point segment A.4 can be implemented directly between business administrative domains I and III as a segment of reference point B.

An example of delegation is given in Appendix I.

7.3 Business role types

The following types of business roles are identified:

- The **consumer** business role is introduced through economic considerations, as it is the only business role consuming telecommunication and information services.
- The **broker** business role is introduced through regulatory considerations to allow all business roles to have fair and equal access to the information that allows them to find services and other stakeholders in an open telecommunication market.
- The **connectivity provider** business role is introduced through technical considerations, since the pace of technological development in the transport resources (mainly hardware based) is different from that in the service resources (mainly software based).
- The **retailer** business role is introduced through economic and technical considerations, according to the concept of retailing in current business environments (sale of goods to the public). The retailer business role is oriented towards customer management and value adding.
- The **third-party service provider** business role is introduced through economic and technical considerations. The third-party service provider is oriented towards production and maintenance of services.

Additional types of business roles can be introduced, if it proves necessary through technical, economic or regulatory considerations.

The types of business roles briefly described above are further explained in the following subclauses. At the end of each subclause a list of high level requirements is given.

7.3.1 Consumer

A stakeholder in the consumer business role takes advantage of the services provided in an open telecommunication market, in the sense that the consumer business role has no interest in making revenue by being engaged in the development or provisioning of telecommunication and information services. This type of stakeholders is the economical base of an open telecommunication market, by paying for the usage of services offered in this market.

The number of stakeholders that are exclusively in the consumer business role is potentially very large – one or several magnitudes larger that the rest of the stakeholders combined. The stakeholders that are in the consumer business role can range from big companies to individuals.

The configuration of the customer premises equipment consequently ranges from small home computers or set-top boxes to large corporate networks (with ten, hundred or more terminals/nodes).

The consumer business role can also be performed by a stakeholder engaged in one or several of the other types of business roles identified in this framework.

The high level requirements on the telecommunication system of the consumer business role are:

- obtain location of retailers, service providers and other consumers;
- (de)register at retailers;
- initiate service relationships that include service providers and other consumers;
- indicate availability to retailers;
- accept invitations to join sessions from other consumers or retailers;
- accept downloads from retailers to upgrade the interaction capability with the retailer.

7.3.2 Retailer

A stakeholder in the retailer business role serves stakeholders in the consumer business role. The number of retailers that can be engaged in a global open telecommunication market, can be anything from a few to thousands. A stakeholder in the retailer business role can be anything from a large corporation to a small "garage" company.

Stakeholders in the consumer business role can use one or more stakeholders in the retailer business role. The lifetime of a relationship between a particular consumer and a particular retailer can vary from seconds to years.

A retailer can deploy a new service for immediate use by any consumer without consulting or standardizing the services with other retailers. This is an absolute requirement that accommodates the present and future telecommunication business dynamics by enabling rapid service deployment.

The retailer provides a "supermarket" or special feature shop to consumers. In order for a retailer to provide its services, support from other business roles can be necessary. Supporting business roles are identified, i.e. broker, third-party service provider and connectivity provider (see below).

Again, a stakeholder in the retailer business role can also perform one or more of the other business roles identified in this framework, e.g. a particular stakeholder can perform the business role of retailer, broker and a connectivity provider at the same time.

The high level requirements on the telecommunication system of the retailer business role are:

- Manage (de)registration to obtain various services (including person-to-person communication, if desired) by consumers.
- Manage (de)registration to provide various services by third-party service providers.
- Authorization prior to service usage.
- Maintenance of session-level user service profiles and treatment policies.
- Session Management, communication to establish and maintain the association list of parties and resources that partake in a session with session owners and session policy information for the purpose of establishing access to the session.
- Control and management of stream flow connections (supported by the connectivity provider) related to the session.
- Manage download to consumers and service providers to upgrade the interaction capability with them.
- Collecting accounting information for the purpose of billing, in the general, for each invoked service (including network connectivity) as well as for the services of the retailer.

7.3.3 Broker

Stakeholders in the broker business role provide all stakeholders with information that enables them to find other stakeholders (business administrative domains) and services in an open telecommunication market.

In an open telecommunication market, the possibility exists for any stakeholder to establish a logical contact with any other stakeholder. The opportunity to obtain address information of other stakeholders and services is supported by generic mechanisms. The broker business role provides the service of finding the requested stakeholders and services. This service has a common value for all stakeholders avoiding "hard-coded" (fixed) references to other stakeholders and services.

The following basic information is to be provided by a broker:

- In response to a name, provide references to business administrative domains (instances).
- In response to a set of criteria, provide names of services (class of services, not instances) matching the criteria.

The first bullet provides a directory function similar to the White Pages, where given a business administrative domain name, an interface reference of the point of contact is provided.

The second bullet provides a directory function similar to the Yellow Pages, where given a set of criteria, a matching service (and possibly the provider of the service) is found. The name of the provider can then be resolved into a point of contact reference using the White Pages directory function.

The broker business role is only engaged in two-party interactions, i.e. a single client of the broker uses the operations specified by the broker to retrieve, store, or delete information managed by the broker.

Again, a stakeholder in the broker business role can also perform one or more of the other business roles identified in this framework, e.g. a particular stakeholder can perform the business role retailer and broker "at the same time".

A specialization of the broker is the so-called Level 1 Gateway (L1GW). The L1GW is a service that ensures consumers to have "equal access" to various service providers[2]. An interface to a L1GW can offer a list (menu) of service providers that appears on the consumer's screen. This facilitates the consumer to choose any of the service providers presented.

The high level requirements on the telecommunication system of the broker business role are:

- in response to an identifier, provide a unique end point address or set of addresses;
- in response to a service category, provide a list of identifiers associated with that service category;
- manage the information used to provide the above;
- introduce, update and remove information on business administrative domain instances and service offerings.

7.3.4 Third-party service provider

The objective of a stakeholder performing the business role of a third-party service provider is to support retailers or other third-party service providers with services. These services can be regarded as "wholesale" of services. The third-party service provider can provide service logic, content or both.

The difference between the business role third-party service provider and the business role retailer is that by definition the third-party service provider does not have a contractual relationship with the business role consumer.

Again a stakeholder performing the third-party service provider business role can also perform one or more of the other business roles identified in this framework, e.g. a particular stakeholder can perform the business roles retailer and third-party service provider "at the same time".

The high level requirements on the telecommunication system of the third-party service provider business role are:

- obtaining location of retailers;
- (de)registration at retailers;
- indicating availability to retailers;
- accepting download from retailers to upgrade the interaction capability with the retailer;
- providing uploads to retailers;
- establishment of provisioning relationship to other third-party service providers;

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[2] Introduced in the USA by the F.C.C. to promote competition between service providers.

- collecting accounting information for the purpose of billing for service usage;
- provision and management of services;
- value adding of services from other third-party service providers.

As a specialization of the Third-Party Service Provider role, a Management Provider could be defined. A Management Provider would provide necessary management functions for provisioning and maintaining system resources, as well as for billing appropriate parties which use the system.

7.3.4.1 Content Provider

The content provider business role is a specialization of the third-party service provider business role and as such it is not a separate business role type. A stakeholder performing this business role is purely focused on the generation of content.

The additional high level requirements on the telecommunication system of the content provider business role are:

- authoring of content;
- delivery of content;
- management of content (version control, etc., copyright protection, licensing) either locally or in the domain of other third-party service provider;
- access provision to content, either for caching in other third-party provider domain or for usage by consumers directly.

7.3.5 Connectivity provider

A stakeholder performing the business role of the connectivity provider owns (manages) a network (switches, cross-connects, routes and trunks). This network can constitute the transport network to support user connections or can constitute the kernel transport network to support the interconnection of the nodes of the Distributed Processing Environment (DPE) which is the runtime execution environment of the telecommunication and information services.

The connectivity provider business role offers an interface to the retailer and third-party service provider business roles, which enables them to request connections between arbitrary end-points of the global telecommunication network.

The connectivity provider federates with the business roles (consumer, retailer and third-party service provider) that terminate the connection at the rim of the network.

The global transport network is segmented in a number of subnetworks controlled by different stakeholders performing the connectivity provider business role. The connection management of each of these segments belongs to a particular business administrative domain. Federation between different connectivity provider business roles is required, to allow management (set-up, removal, etc.) of connections routed through two or more network segments belonging to different stakeholders performing the connectivity provider business role.

The "paradigm" of layer network is supported. A client/server relationship can exist between the connectivity provider that manages the client layer network and the connectivity provider that manages the server layer network. The client layer network uses resources of the server layer network.

Again, a stakeholder performing the connectivity provider business role can also perform one or more of the other business roles identified in this network, e.g. a particular stakeholder can perform the business role retailer and connectivity provider "at the same time".

The high level requirements on the telecommunication system of the connectivity provider business role are:

- set up and manage bindings between network flow endpoints either with or without connections;
- adding and modifying these bindings (e.g. adding branches or media to a connection configuration);
- managing these bindings (e.g. fault, security, etc.);
- collecting accounting information for the purpose of billing for network connectivity.

7.4 Business relationships types

To allow the business role types identified in 7.3 to interact, a set of business relationship types is identified in the subclauses below. Some of the business relationship types appear more than once denoting multiple occurrence of the same business relationship type between different business role types (e.g. the consumer, the retailer, the third-party service provider and the connectivity provider have the same business relationship type with the broker). However, although the business relationship types and thus the interactions are the same, the information carried can be entirely different.

Additional business relationship types may be introduced, in the case that additional types of business roles are introduced, or if it proves necessary, through technical, economic or regulatory considerations.

7.4.1 Generic access inter-business administrative domain interactions

These interactions are generic to all inter-business administrative domain interactions and support the establishment of a relationship between the business administrative domains. These interactions need to be performed before any of the other interactions can take place:

- initiation of dialogue between the business administrative domains;
- identification of the business administrative domains to each other (note that either domain may remain anonymous depending on the interaction requested);
- establishment, release and management of a secure association;
- establishment of billing/accounting conditions in relation to;
- service (including management services) discovery and start;
- establishment of the initial management context (setting the policies for e.g. availability, reliability and fault handling);
- negotiation of the initial usage interactions (i.e. exposing the information objects and computational interfaces for provisioning of services).

7.4.2 Retailer business relationship (Ret)

The Ret business relationship is used between stakeholders in the consumer business role and stakeholders in the retailer business role. The following interactions are performed in this business relationship:

- generic access interactions;
- discovery and start of operational, management and administrative (e.g. subscriber profile management) service offerings;
- control and management of sessions (e.g. announce, stop, suspend, invite, notify changes, negotiate transfer of control rights) on the entities participating in a service session;
- control and management of stream flow bindings;
- control and management of stream flow content.

7.4.3 Broker business relationship (Bkr)

The Bkr business relationship provides access to and management of the information controlled by the broker business role, by any other business role.

Different stakeholders performing the broker business role interact with each other, to complement their own information, using the same Bkr business relationship interactions as all other business roles.

The following interactions are performed in this relationship:

- generic access interactions;
- (de)registration of business administrative domain instance names;
- (de)registration of service offers and their attributes;
- management interactions (e.g. update, delete, add) on the above information.

7.4.4 Third-party business relationship (3Pty)

A stakeholder performing the retailer business role interacts with a stakeholder performing the third-party service provider business role to provide a broader range of services to its consumers without actually possessing the services, using the 3Pty business relationship. Different stakeholders performing the third-party service provider business role interact with each other, to provide supporting services, using the same 3Pty business relationship.

The following interactions are performed in this relationship:

- generic access interactions;
- interactions defined for the Ret business relationship;
- control and management interactions for services and/or service content;
- management interactions for service offerings in the retailer domain or another third-party service provider domain (e.g. version control).

7.4.5 Retailer-to-Retailer business relationship (RtR)

Different stakeholders performing the retailer business role interact with each other, to facilitate end-to-end user connections, using the RtR business relationship.

The RtR business relationship reuses the functionality of the 3Pty and the Ret business relationships considering the fact that the information passed over the reference point may be different, but the actual interactions are not.

7.4.6 Connectivity service business relationship (ConS)

The ConS business relationship is defined between the connectivity provider business role, providing network transport services, and the business roles of retailer and third-party service provider which are requesting the transport connectivity services. The business role requesting the connections need not be connected to any network access point (third-party control).

The following interactions are performed in this relationship:

- generic access interactions;
- control and management of third-party connections between parties (end-to-end network connectivity);
- setting and management of management contexts for the connectivity service (e.g. accounting method to be used, configuration to be reported, etc.).

7.4.7 Terminal connection business relationship (TCon)

The TCon business relationship provides the management link between the connectivity provider business role and the business roles of the parties involved in end-to-end network connectivity.

The TCon business relationship is closely related with either the Ret or 3Pty business relationships for which it performs the connection termination.

Since the Network Termination Points are technology dependent [e.g. ATM, B-ISDN, N-ISDN, Internet (IP)], the implementation of the interactions on the TCon business relationship is also technology dependent. The following interactions are performed in this relationship:

- generic access interactions if not covered by the Ret or 3Pty business relationship implementation;
- negotiation about and control of the layer network interconnection (e.g. configuration of concentrators, selection of channels, etc.);
- control of first party connection set-up (e.g. in case where the connectivity provider provides kernel transport network connections).

7.4.8 Layer network federation business relationship (LNFed)

The LNFed business relationship is the federation relationship between connectivity provider business roles. The LNFed business relationship enables the provisioning of a connectivity service spanning multiple business administrative domains implementing the connectivity provider business role, through the ConS business relationship of one of these business administrative domains.

The following interactions are performed in this relationship:

- generic access interactions;
- control and management of tandem connections;
- management of topological links between the connectivity provider's networks (e.g. to support dynamic re-routing in fault conditions).

7.4.9 Client-Server Layer Network relationship (CSLN)

The CSLN business relationship enables the use of layer networks between business administrative domains performing the connectivity provider business role. The following interactions are performed in this relationship:

- generic access interactions;
- control and management of trails in the server's layer network.

7.5 Business model

The business model defines a framework to specify reference points and propagate requirements on an SPFEE system. It provides the machinery to specify, add and modify reference point and business roles in an SPFEE system.

An SPFEE system is based on a Distributed Processing Environment (DPE). The implementations of the service architecture and the network resource architecture are applications that run on the DPE, i.e. they belong to the application layer of SPFEE. The reference points specifications describe the interactions between these applications as well as the supporting DPE platforms in all of the viewpoints used by SPFEE.

Reference points specify SPFEE conformance requirements. To claim conformance to SPFEE, one or more of the reference points have to be acknowledged. An implementation can conform to these reference points and conformance to the reference points can be tested.

The initial set of SPFEE business roles is identified by analyzing the current business relationships in Telecommunication and Information Services. The separations are driven by the following types of business separations:

- **Technical**: Areas of different development speed of technology are placed in different business roles (e.g. separation between retailer and connectivity provider = speed of service development vs. speed of network development).
- **Economic**: Business roles which are considered consumers and producers of services in today's information market are assigned to different business roles (e.g. separation between consumer and other business roles and separation between the retailer and third-party service provider).
- **Regulatory**: Due to regulatory constraints certain separations of business roles are induced (e.g. between broker and other business roles to allow fair and equal access to retailers).

The following types of business roles were identified for the initial set in SPFEE (see Figure 7-4):

- The consumer business role is introduced through economic considerations, as it is the only business role consuming the SPFEE services and not trying to make money of them. All other types of business roles are characterized as producers or middlemen.
- The broker business role is introduced through regulatory considerations to allow all business roles to have fair and equal access to the information that allows them to find services and other stakeholders in the SPFEE system.
- The connectivity provider business role is introduced through technical considerations, since the pace of technological development in the transport resources (mainly hardware based) will be different from that in the services resources (basically software based).
- The retailer is separated from the third-party service provider business role through economic as well as technical considerations. Using present day models (e.g. supermarkets) as an example. The production of services (e.g. a movie) requires a different business set-up and technical skills than the offering of this movie (e.g. a video shop). The retailer business role is oriented towards customer management and value adding, while the third-party service provider is oriented towards production and maintenance of the service.

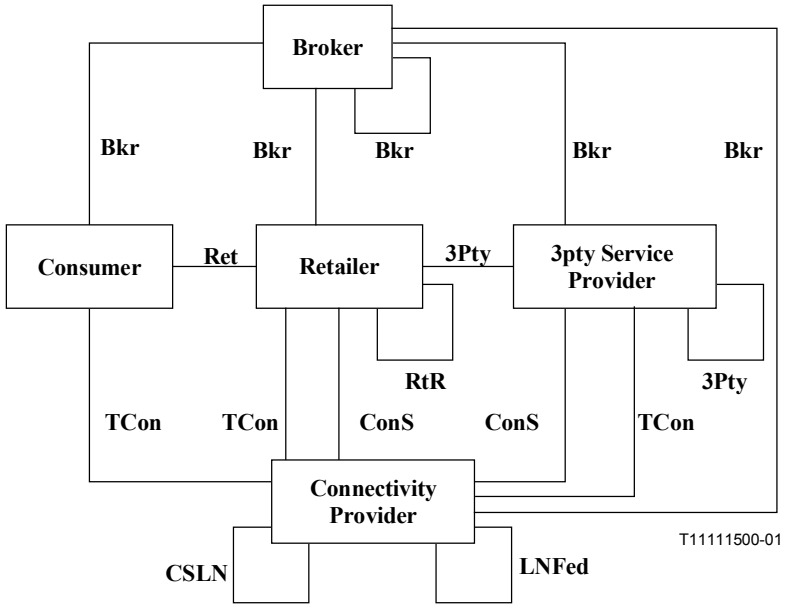

Figure 7-4 – Initial SPFEE business role types and business relationship types

All of these business roles play the role of user and provider towards specific other business roles (e.g. a retailer *provides* services to the consumer and thus performs the provider role, but *uses* services from the connectivity provider and thus performs the user role). Whether a provider or user role is played is determined by the contract governing the interaction between the business roles.

Business roles can be combined in business administrative domains to suit the needs of the stakeholder for its particular business. In this translation, the business relationships, which express the interaction requirements between the business roles, are mapped into reference points.

Two types of reference points are defined: inter-domain reference points and intra-domain reference points.

Inter-domain reference points: This type of reference point can be described as the specification of interoperability requirements between business administrative domains. The following inter-domain reference points are currently being specified in SPFEE based on the identification of initial business roles and business relationships in SPFEE:

- Retailer inter-domain reference point (Ret);
- Broker inter-domain reference point (Bkr);
- Third-party inter-domain reference point (3Pty);
- Retailer-to-Retailer inter-domain reference point (RtR);
- Connectivity Service inter-domain reference point (ConS);
- Terminal Connection inter-domain reference point (TCon);
- Layer Network Federation inter-domain reference point (LNFed);
- Client-Server Layer Network inter-domain reference point (CSLN).

In Figure 7-4 the business model used for the initial set of SPFEE reference points is illustrated; this model shows five "key-business areas" among which relationships are identified. The selection of these business roles is based on both the ODP Enterprise viewpoint, the fundamental architectural properties of SPFEE and market analysis. The business relationships in the business model are used to identify/define the application related inter-domain reference point parts.

Intra-domain reference points: This type of reference point can briefly be described as specification of conformance requirements for interoperability between components that interwork within an administrative domain.

The following intra-domain reference points have been defined:

- Terminal intra-domain Reference Points (Term-RP);
- End-to-end Communication intra-domain Reference Point (EECom-RP);
- Network Management Layer intra-domain Reference Point (NML-RP);
- Element Management Layer intra-domain Reference Point (EML-RP);
- Connection Management Configuration intra-domain Reference Point (CMC-RP).

To identify intra-domain reference points, the computational object model of SPFEE is used. Intra-domain reference points are a set of interfaces identified because they are the most likely to be provided by different component vendors.

The intra-domain reference points as well as the inter-domain reference points can be used as conformance requirements to vendors who want to provide components that can be used to build an SPFEE system.

8 Overall Architecture Description

The primary functions of Session Management are to maintain the representation of session, support manipulation of session, and coordinate resource negotiation among session members with disparate capabilities. Members may include users and servers. A user typically represents a person and the devices and applications the person directly interacts with in order to participate in a session. A server, on the other hand, provides to other members of a session with services, such as billing and credit card authorization.

A session can be created, destroyed, suspended, or resumed. Sessions can be associated or dissociated with one another. In addition, sessions may span multiple networks. To participate in a session, members can be added to the session. Also to leave a session, members can be dropped from the session. This abstraction of communications allows for association of arbitrary number of users and heterogeneous servers into a single entity and for users and servers to be added to and removed from it dynamically. An example of Session extension is that a two-party voice session can be turned into a multiparty conference session with a video and a multipoint-shared application by adding additional parties, a video conferencing server, and a shared data server to the session.

One of the things Resource Management does is to abstract details of underlying physical communication networks and provide a stable API for a variety of communication networks. As such, entities can communicate with each other by using their individual virtual transport addresses (e.g. Resource IDs).

8.1 Information Model of Major Session Classes

Figure 8-1 shows relationships among major information objects of the Session and Resource Level. This figure is drawn in the OMT notation.

The explanations of the information objects in the figure are given in the following subclauses.

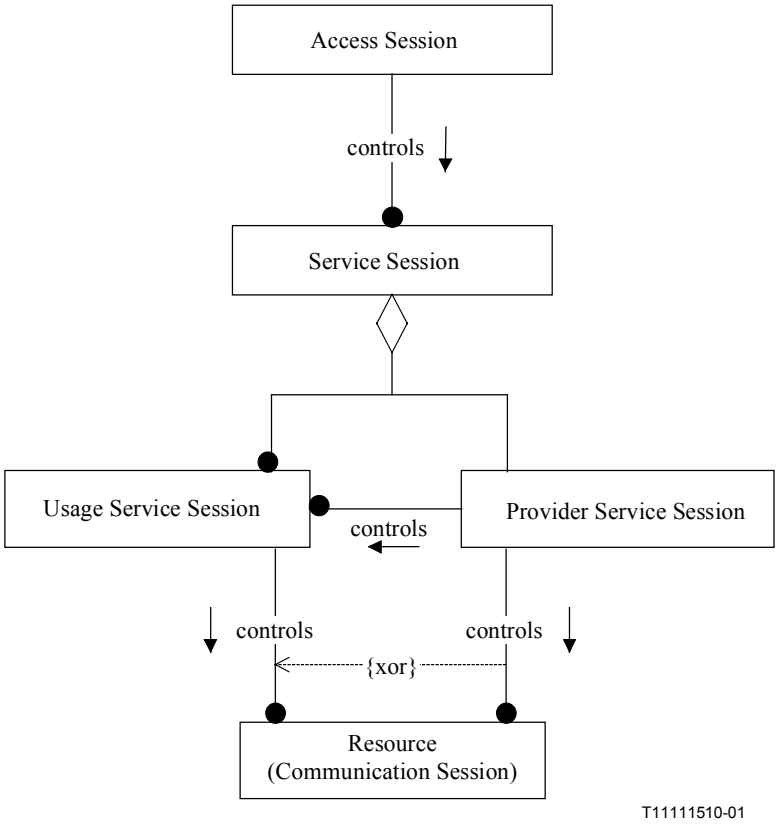

Figure 8-1 – Information Model on Sessions

8.1.1 Access Session

An access session is established when the provider and the user interact. The early stage of the access session is the agreement of terms between domains to continue interaction and authentication of the roles. Security protection may be delegated to subsequent service sessions. Domains that offer service will enforce certain policies in the access which are derived from the commercial and technical aspects of the contract. Policies are held in the user profile information.

The access session represents:

- **A doorway** to the system of Year 2000+ services offered by one domain to another. A requesting domain may request services independently of the service location.
- **Customized access** to Year 2000+ services, the interaction between domains is customized by previously arranged user specific profiles, taking into account the end-user's preferences or terminal capabilities. Note that determining the profile is not part of access session functionality, but done in a specific service session.
- **Mobility** – Ubiquitous access to the system of Year 2000+ services, irrespective of the terminal being used and the point of attachment to the network.
- **Secure** access – The means to create a secure binding between the two domains.

From an access session many service sessions may be invoked, which are the responsibility of the access session until they are terminated or assigned to another access session (of the same or a different user). The access session can be terminated by either domain.

8.1.2 Service Session

A service session represents information and functionality related to capabilities to execute, control and manage Year 2000+ services. The capabilities include service specific control, generic session controls, and management capabilities. A service session is an instance of a service type and includes information necessary to negotiate QoS, security context, use of service and communication resources, and to control relationships among participating members of the service session.

The service session comprises a provider service session, and usage service session(s). The provider service session represents the core service logic and control for the one or more domains participating in the service in one role or another. The usage service session represents the participation of other domains with the provider service session.

When a service session is started, or when a new member joins a service session, it acquires the relevant user profile information from the access session for the member. This constrains the usage service session and potentially the provider service session. In the case of multi-member service sessions, an individual's user profile or current usage configuration may affect the whole service session, depending on the nature of the service and its management policies.

A service session can be instantiated by an access session or another service session. The initiator of a service session associates it with its member(s). Members may have different responsibilities within the session (e.g. management or purely interaction with the service content and general session control).

If a service session is the responsibility of an access session, the service session can remain active while that access session is active. When that access session ends, the service session must be assigned to another access session (same or different participant). In either case, when the access session is ended, the related usage service session must be suspended or ended.

8.1.3 Provider Service Session

A provider service session contains a central view of the service session, including all members and any additional provider information and logic necessary to execute service requests and maintain the session. Support of this session is the responsibility of the provider. A provider service session represents the service capabilities common to multiple members. Generally, the provider service session holds information objects related to the management view of the service (e.g. accounting) or system related information of the service. During its lifetime a provider service session may invoke, and otherwise control many resources (including communication sessions).

8.1.4 Usage Service Session

A usage service session contains the member's (e.g. an end-user's) customized view of a service. It hides service complexity from the member and ensures that the member's preferences and environment are supported by the service. It hides the heterogeneity of each usage configuration from the provider service session.

8.1.5 Resource (Communication Session)

A resource (communication session) represents a general, service view of stream connections and a network technology independent view of the communication resources required to establish end-to-end connections. A resource (communication session) can handle multiple connections which may be multipoint and multimedia.

A resource (communication session) can arrange QoS, set up, modify, and pull-down multiple connections.

A resource (communication session) is controlled by one service session from the provider service session or usage service session. Only one service session may be associated with a resource (communication session) at any one time.

8.2 Computational Model of Major Session Classes

This chapter defines the components to support the information model in the previous clause. These components are defined in the computational viewpoint. They map to computational objects or computational object groups. However, the concept of component is more general: it does not force any particular mapping to computational objects, leaving this open to designers to choose. This freedom is required to provide the desired flexibility.

This chapter first defines what a component is, then presents definitions of the components.

8.2.1 Definition of Component

This subclause defines the component concept, and its relationship to computational objects and object groups.

Components are defined in the ODP computational viewpoint, and the definition of an individual component is a computational specification.

This Supplement defines a set of components which provide a framework for segmenting the functionality of systems. Components can be used together to provide some functionality of a system. The components, which are defined in the following subclauses, are high level abstractions, which can be decomposed into COs and COGs. It is up to the designer of the system to decide precisely how each component is decomposed into COs and COGs. This Supplement would not place any restrictions on how the components are decomposed and deployed.

COs are defined as a unit of distribution over a DPE node. If a component were defined as a CO type, then all the functionality represented by the component would have to be supported by a single

DPE node. However, the architecture should not force a service component instance to be supported by a single DPE node.

COGs are not defined as a unit of distribution. However, COGs are only defined in terms of their internal COs and COGs. (A COG type is specified by listing the CO types that are part of the group.) COGs do not encapsulate (or hide) their internal structure. This Supplement would not define the internal structure of any of the components. (The internal structure of components is decided by the system designers.)

So the component concept is defined to allow a component to be decomposed into any combination of COs and COGs. Therefore, components map to these entities: COs and COGs; interfaces of components also map to interfaces of COs and contracts of CO groups.

A component is an entity with the following properties:

1) It encapsulates data and functionality in the computational viewpoint.
2) It offers computational interfaces to other components and uses computational interfaces of other components.
3) It can map to the following:
   - a computational object;
   - a set of interacting computational objects;
   - a computational object group;
   - a set of interacting computational objects and computational object groups.
4) All CO mappings of component type are equivalent, i.e. they can be seamlessly interchanged with no effect on the external world.
5) The component is defined as a single computational object, with all its interfaces defined in IDL. This is a CO representation of the component and is used to unambiguously define the interfaces of the component. (It does not mean that the component is restricted to distribution on a single DPE node, as a CO is.)

There may be several CO mappings for a component, thus enabling flexible design (e.g. in terms of distribution); in other words, there are several CO mappings for a component. The representation defined in item 5) is chosen uniquely here, thus enabling each component to be unambiguously specified in IDL.

Figure 8-2 shows three examples of different mapping for a component S. All of these mappings are equivalent at the component level and can be seamlessly interchanged. Each example offers the same external interfaces for the component.

Each mapping may provide some benefit to the system designer (e.g. improving system performance by allowing different deployments of COs, or allowing better reuse of CO code). Other mappings are also possible. None of the mappings can be distinguished at the component level, (Unified View). Cases 1 to 3 represent possible *mappings* of component S to structures of computational objects and object groups.

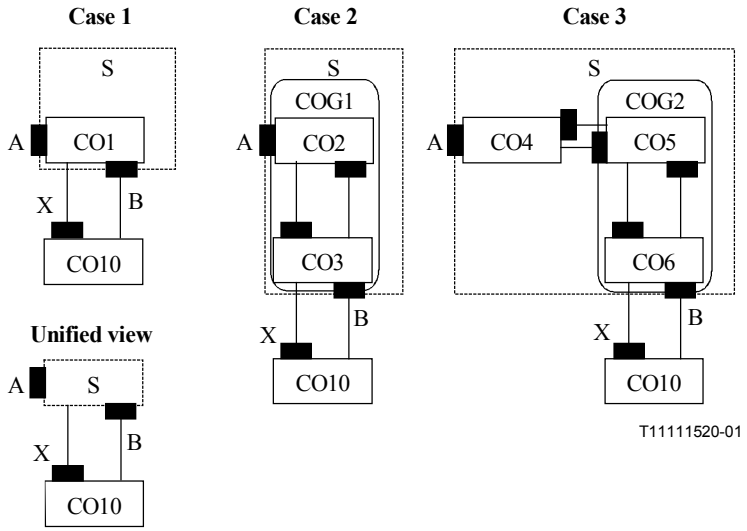

Figure 8-2 – Components and their relationship to COs and COGs

8.2.1.1 Using components

The computational model provides a framework to offer a set of generic functionalities, in a stakeholder-independent, service-independent, and inter-operable way. This is achieved by a set of generic components and their interfaces. These components are defined in the following subclauses. Reference points are also defined among some components. These reference points define points of inter-operability among domains and within a domain. Reference points never occur within a service component, only among some of them.

System designers will also want to provide additional functionality to that defined by the computational model, in order to provide some competitive added value for their system This can be achieved by making it possible to derive new components from existing ones; this is done according to two paradigms:

- specialization;
- specialization and composition;

Specialization allows a component to be extended through inheritance. A specialized component inherits all the functionality of the "parent" component, and can add some new functionality. However, the specialized component must still provide all the functionality of the parent component. This functionality must be assessable through the same component interfaces. The specialized component must provide all of the interfaces provided by the parent component. These interfaces must either be subtypes of the interfaces on the parent component, or be of the same type. (The specialized component may also provide additional interfaces not supported by the parent component.)

Specialization ensures compatibility between specialized components, by ensuring that they can be treated exactly as if they were their parent components. To check that a component is a specialization of a parent component, the CO representation of the two components must be considered. If the CO representation of the specialized component is a specialization of the CO representation of the parent component, then the specialized component is definitely a specialization of the parent component. (For each interface supported by the CO representation of the parent component, either that interface type, or its subtype must be supported by the CO representation of the specialized component.)

Specialization can be used to design components that provide the same functionality as pre-defined components, but provide subtypes of the interfaces to support both the pre-defined and provider specific functionality.

Composition allows a component to be extended through aggregation. Paradigm b) above refers to "specialization and composition", not "composition" alone, because a component cannot have functionality added and still is the same type of component, it must be a subtype (or possibly a completely different type).

Aggregation allows COs and COGs to be added to a component. When this adds new external interfaces to the component, then the component becomes a specialization of the parent component, i.e. the new aggregated component has all of the interfaces of the parent component, plus some additional interfaces. It can be treated exactly as a parent component.

Composition through aggregation can be used to design components that contain generic components defined by the proposed computational model and additional specific components. The new components provide all the same functionality of the proposed components, and the same interfaces, but also provide additional interfaces to support provider specific functionality.

In summary, the same computational specification for a component can correspond to several structures of COs and CO groups (for example, case 1 to 3 in Figure 8-2), potentially distributed over several DPE nodes. Such structures can be interchanged without any impact, at the computational level, on the clients and servers of the component in question. Furthermore, the particular structure to adopt can be left up to the designer without sacrificing accuracy of the specification.

8.2.2 Overview of Components

This subclause gives an overview of the computational model in terms of components.

The components are categorized as follows:

- access related components, supporting interfaces which provide user's universal access to services;
- usage related components, supporting interfaces which allow users to use (interact with) a service;
- communication related components, supporting interfaces which control communication services (stream flow connections).

Components are also separated according to the business administration domain's role for access and usage. Table 8-1 lists the proposed components. Definitions of these components can be found in the following subclauses. All the components have to be mapped onto computational objects and groups, as explained.

Table 8-1 – Components

Category	Domain Role	Name of the Component	Abbreviation
Access Session related	User Role	User Application	as-UAP
		Provider Agent	PA
	Provider Role	Initial Agent	IA
		User Agent	UA
		Named User Agent	namedUA
		Anonymous User Agent	anonUA
Service Session related	Party Role	User Application	ss-UAP
	Provider Role	Service Factory	SF
		User Service Session Manager	USM
		Service Session Manager	SSM
Communication Session related	User Role[a)]	Terminal Communication Session Manager	TCSM
	Provider Role	Communication Session Manager	CSM
[a)] Other roles may occur here.			

8.2.2.1 Example of User-Provider Roles

Figure 8-3 gives an example of how some of these components can interact, categorized as above. This figure shows a simple case of two users using a service in a provider domain. The following overview describes the components in a scenario where the provider domain acts in both an access provider role and a usage provider role. Scenarios where domains take different roles in the access and usage parts are also possible, and are described later.

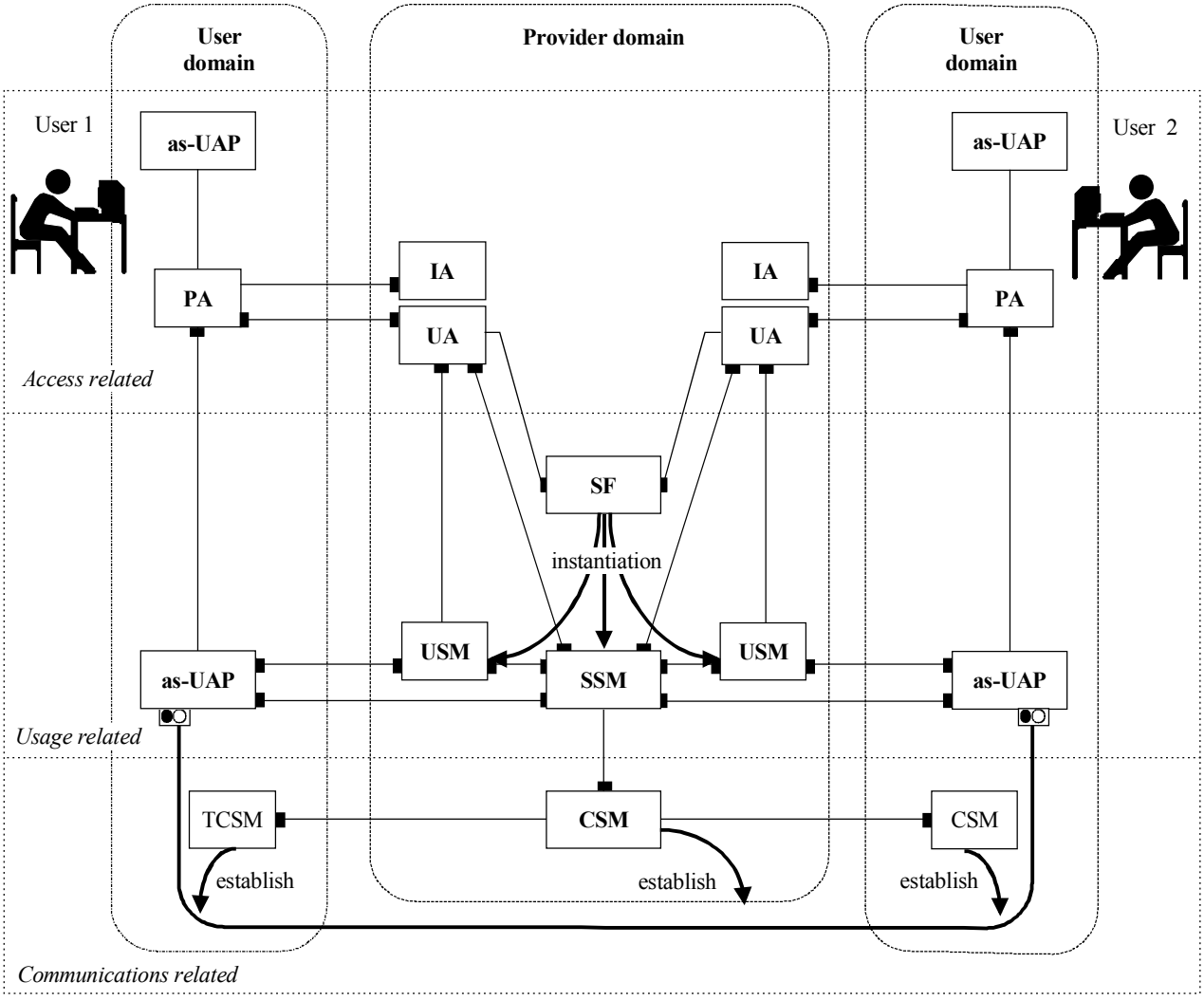

Figure 8-3 – Example of User-Provider roles using service components

Access session related components provide a framework for offering secure and personalized access to services and for supporting mobility. The **Initial Agent (IA)** is the initial contact point for the **Provider Agent (PA)** wishing to interact with the provider, and is used to gain an access session with the **User Agent (UA)**.

The PA and UA components interact within a secure, trusted relationship between the user and the provider (an access session). They support authorization, authentication and customization of the user's service access and provide a secure mechanism for starting and joining sessions. In terms of the access session, the user domains take access user roles; the provider domain takes an access provider role.

The **access session related User Application (as-UAP)** provides the user interface for the user to interact with the provider. It interacts with the PA to perform user requests, e.g. to establish an access session, and use services.

Service session related components provide a framework for defining services which can be accessed and managed across multiple domains. In the provider domain, **Service Session Managers (SSMs)** and **User Service Session Managers (USMs)** are instantiated by **Service Factories (SFs)** based on requests from UAs. An SSM and USM provide session control capabilities – an SSM supports those shared among the users, and a USM supports those dedicated to a user. The **service session related User Application (ss-UAP)** in the user domain allows a user to interact with a service session and acts as an end point for session control. In terms of the service session, the user domains each take a usage party role; the provider takes a usage provider role.

The Resource (communication session) related components provide end-to-end connectivity. Figure 8-3 shows a **Communications Session Manager (CSM)**, using a **Terminal CSM (TCSM)** to establish a stream binding between two stream interfaces on the users' UAPs.

Other service specific components may be necessary in addition to those in Table 8-1. For example, for a video-conferencing service, it may be useful to model the video bridge as a service specific component, separated from the service session components. For example, the video bridge may have both operational interfaces (to control the bridge, i.e. the composition of video pictures or the sound level) and stream interfaces (e.g. as sinks of flows from the conference participants and sources of merged video flows). The definition of individual components is outside of the scope of this Supplement.

Examples of the dynamics of the interactions between the components are given in [6]. Some objects support more than one interface. Separate interfaces have not been shown in this diagram.

8.2.2.2 Service Components and Domains

Domains can assume a number of access and usage roles. For access, a domain can support user or provider roles, depending on reference point requirements. For instance, across the Reference Point between Consumer and Retailer, the retailer supports the access provider role and the consumer supports the access user role. For example, for an end-user (consumer) wishing to use services provided by a retailer, the consumer domain takes a user role, and the retailer takes a provider role.

For usage, a domain can support usage party and usage provider roles. For example, for an end-user (consumer) using a library service provided by a retailer, the consumer domain takes a usage party role, and the retailer takes a usage provider role.

However, a domain can support a number of different usage roles across the same reference point, and these roles need not be the same as their corresponding access roles. For the LRP-CR, an access user is usually also a usage party (as in the examples above), but, for LRP-RR (Logical Reference Point between Retailer and another Retailer), the access user may be a usage party or provider.

Components are defined according to the roles that they take. The components are generic, so that they are applicable to whichever role the business administration domain takes. However, this may also require that components are specialized depending on the administrative domain in which they are used.

The domain encompasses the business's hardware and software systems. These systems may vary considerably depending on the administrative domain and the role they take. The computational model does not specify details of the internal structure of the domain systems. Modeling of them is limited to identifying capabilities required to use services. However, it does assume that the components interact through a DPE and make use of other components and services, inside and outside the domain.

For example, a domain taking the access user role may be a single end-user, with the user's systems consisting of a single terminal with a direct physical connection to a network connectivity provider. Or it may be a large site, encompassing a network of many terminals and other communications and computing resources, with one or more physical connections to one or more network connectivity providers. The components defined are generic enough to be applicable in both situations.

APPENDIX I

Example of delegation

In Figure I.1 the computational part of a delegation example is given. The usage segment of the reference point 3Pty-RP is identical to the usage segment of the reference point Ret-RP. This allows the business role Retailer to delegate the usage segment to the business role Third-party Service Provider.

Business administrative domain John, accesses business administrative domain Telecom to use a specific video conference service. Business administrative domain Telecom does not provide this service itself but has a contract with business administrative domain Conference Co. performing the business role Third-party Service Provider that provides this service.

Instead of executing the service in the business administrative domain Telecom, or passing through all interactions, the service is executed in the business administrative domain Conference Co. the interactions take place directly between John and Conference Co.

Delegation is transparent to John, i.e. to him it appears like Telecom is offering and providing the service. Telecom is responsible for John's interaction with Conference Co. and performs John's subscription management, customization, etc. John pays Telecom for service usage, and Telecom pays Conference Co.

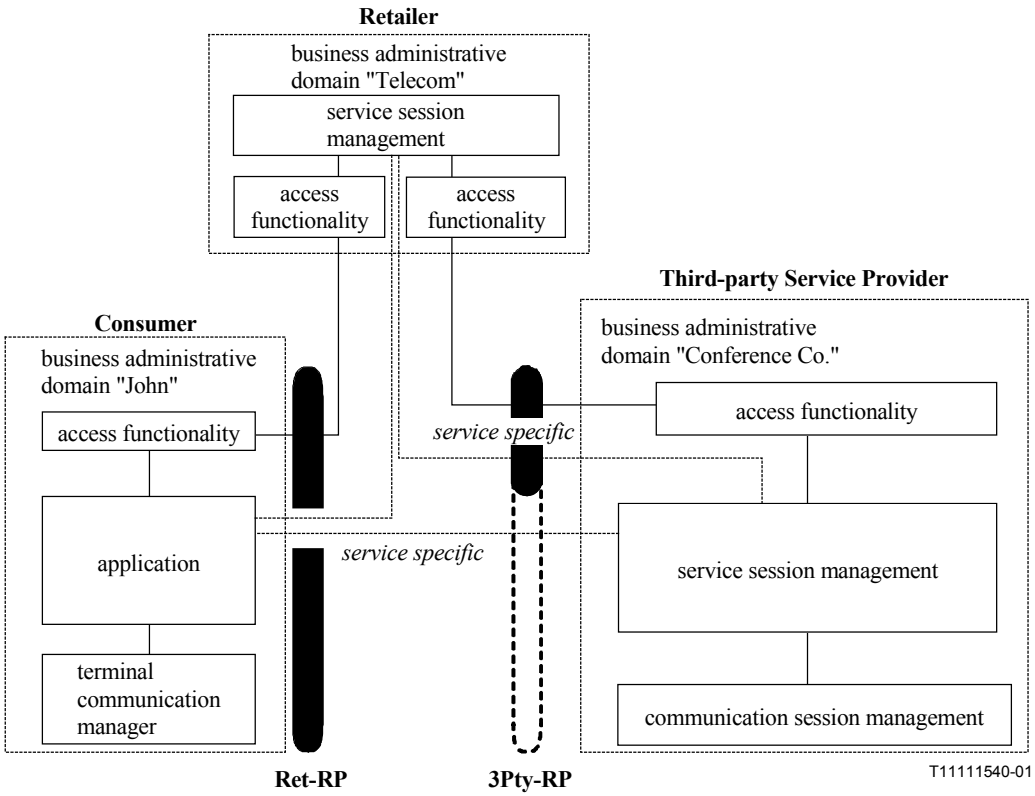

Figure I.1 – Example of delegation – Computational part

APPENDIX II

Application examples of business modelling concepts

This Appendix provides example instances of business models for various services constructed using the business modelling concepts. These examples illustrate some of the key features of the business modelling concepts.

II.1 Present day VoD example

In Figure II.1 an example of the business modelling concepts applied to a present day Video on Demand service as can be found on cable TV systems. The following features are shown:

- The possibility to map two business roles (retailer and connectivity provider) into a single business administrative domain (Coax).
- The possibility to hide contracts. In the contract between the consumer (William Watcher) and the retailer (Coax) a portion guaranteeing the provisioning of special Pay TV services from R-Movie is included.
- The possibility to have one stakeholder (BigCompany) run two business administrative domains (R-Movie and Coax).
- The possibility to perform delegation by the retailer to the connectivity provider to set up connections between the consumer and the third-party service provider.
- The possibility to implement a business relationship as a reference point within a business administrative domain as an inter-operation requirement for components from different vendors (ConS within Coax).

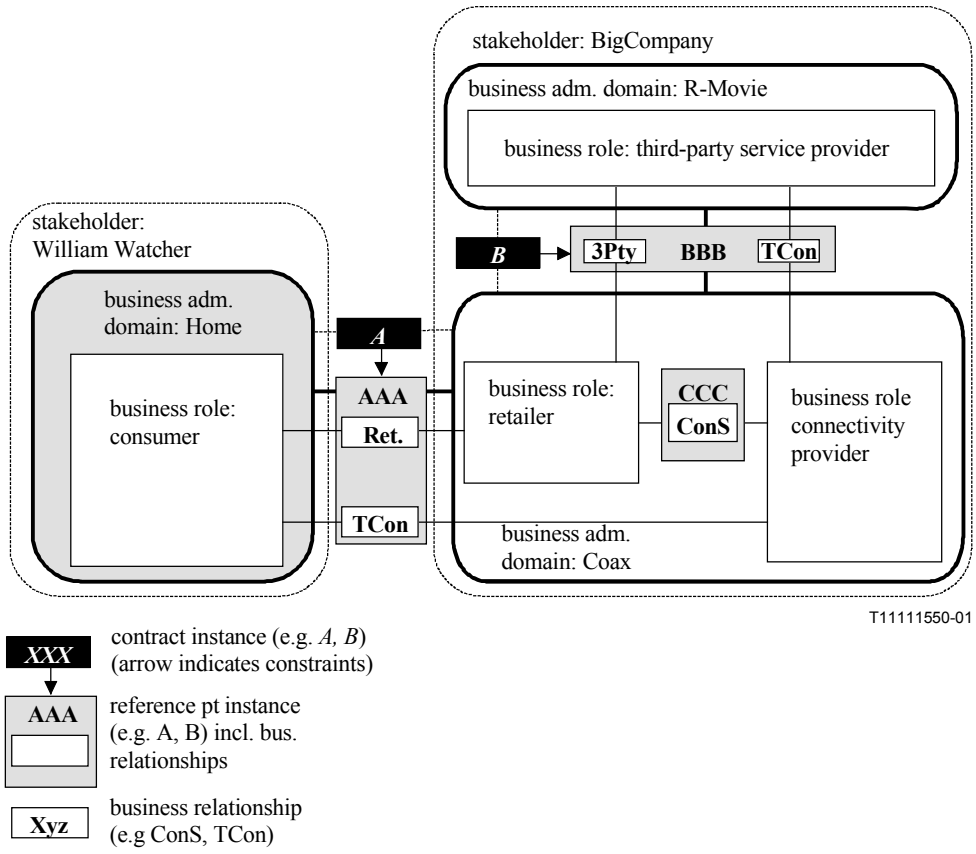

Figure II.1 – Example instance diagram of pay TV provisioning

II.2 Connectivity value adding example

In Figure II.2 simple value adding is shown. The figure shows the situation where a stakeholder performing the business role of the connectivity provider (BasicServiceProvider) sells connectivity to consumers by its retailer business role (e.g. to Christine Caller). A stakeholder performing the business role of the retailer and adding value (e.g. for Video Conferencing) buys connectivity as a normal consumer and utilizes it to support its value adding business. Both providers have ordinary customers as well (Christine Caller and Charley Conferencer). The following features are shown:

- The possibility for a stakeholder to map multiple business roles into a business administrative domain even when there are no predefined business relationships between them. In this case the value added provider (GetTogether) contains both the functionality of a normal consumer towards the retailer role of BasicServiceProvider and a retailer role towards the consumer role of Charley Conferencer supporting the one application that provides the video conference service. The business relationship between the consumer and retailer in GetTogether can be different from the Ret business relationship.
- The possibility to have the same business relationship under very different contracts. In this case the Ret business relationship is used for a single ordinary customer (Christine Caller) as well as to a large volume customer (GetTogether). The difference is implemented through the use of different profiles for the reference point. The implementation of the differences can be performed by picking different segments for management (e.g. different accounting policies).
- Again, the possibility to perform delegation under a contract. The contract between Charley Conferencer and GetTogether will include the provisioning of the TCon business relationship to gain access to the network run by BasicServiceProvider. This business relationship is incorporated in both the contract between GetTogether – BasicServiceProvider and between GetTogether – Charley Conferencer.

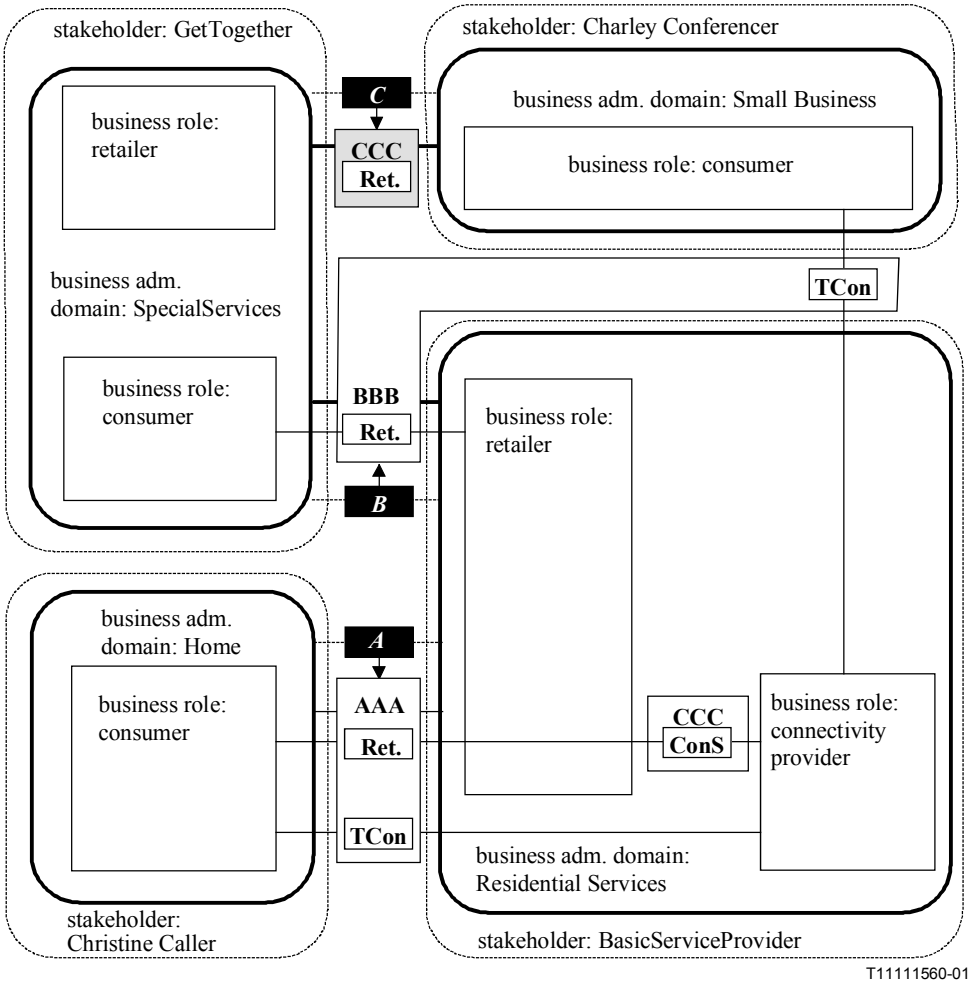

Figure II.2 – Example instance diagram of connectivity value adding

II.3 "Internet" home business example

In Figure II.3 the situation is shown where a stakeholder (typically a small home business) provides services similar to those currently offered on the Internet. The following features are shown:

- The possibility for OnLine to outsource part of its service provisioning to other parties (the third-party service provider side of Harry Hacker).
- The possibility for retailers to refer customers to each other through the RtR business relationship. In this case the consumer side (Home) of Harry Hacker can access the services provided by Online through its retailer Multisource although Harry is not directly subscribed to Online as a customer. Vice versa, Sophia Surfer can set up a communication with the consumer side of Harry Hacker using a connectivity service provided by Multisource through her retailer Online.
- The possibility to have contracts that govern the constraint between more than two parties. In the contact between the retailer OnLine and the connectivity provider MultiSource (tagged: C) there is a portion dealing with special connectivity conditions that Online's external third-party service providers (HarrySoft) are supplied with (e.g. a primary-rate connections on special terms with special tariffs). The same can apply for management conditions, e.g. MultiSource providing special services for managing all of the connections for all Online's independent third-party service providers.

- The possibility to use the business modelling concepts inside a stakeholder in a proprietary way. In this case to have a contract between the two business administrative domains of Harry Hacker. This serves the purpose of specifying the security and access constraints between the two domains. Thus, the implementation of the reference point between the two business administrative domains within Harry Hacker and the constraining contract can be seen as the "firewall" between Harry's two business roles. Although the business relationship is not explicitly identified, the business modelling concepts can be applied.

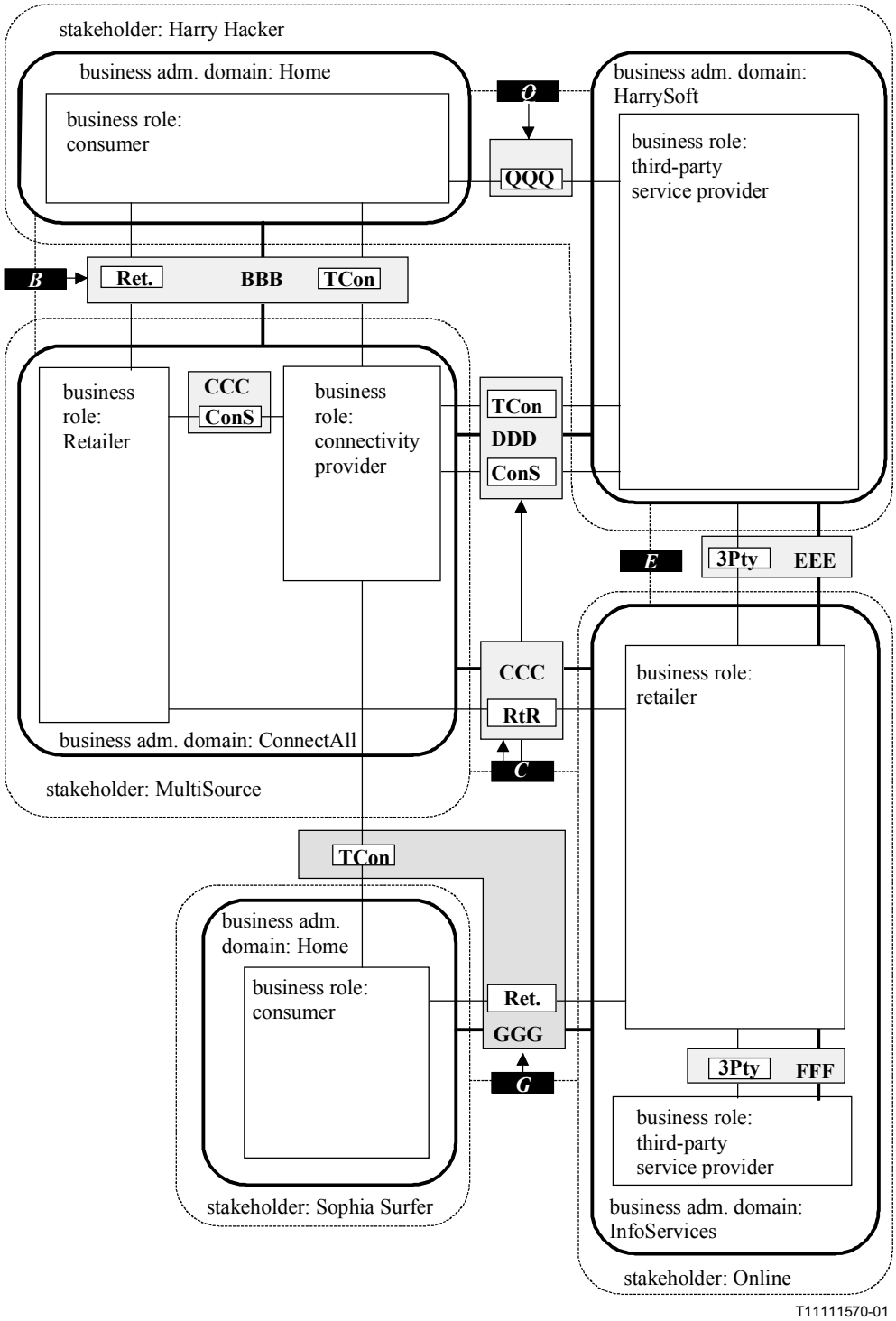

Figure II.3 – Example Internet like service provisioning

II.4 Outsourcing of management example

In Figure II.4 the situation is shown where one business administrative domain has outsourced its management to another business administrative domain. The following features are shown:

- The possibility to separate the segments of a reference point (e.g. ancillary and primary segments) of a reference point between different administrative domains. In this case, ConS is split in an ancillary part providing management functionality (mngt) and a primary part providing operational (opr) functionality. BasicServiceProvider provides the operational part whereas FixItAll provides the management part. These separations still fall under the same contract and business relationship definitions. Ancillary services that have a profound impact on the internal operation of a domain (e.g. element management of a connectivity provider) and still need to be outsourced are considered to be implemented in this way.

The capability to provide the same management services provided by FixItAll for BasicServiceProvider to any customer as a separate service through the retailer role of BasicServiceProvider. This method is considered for ancillary services that are less intrusive (e.g. version management of software).

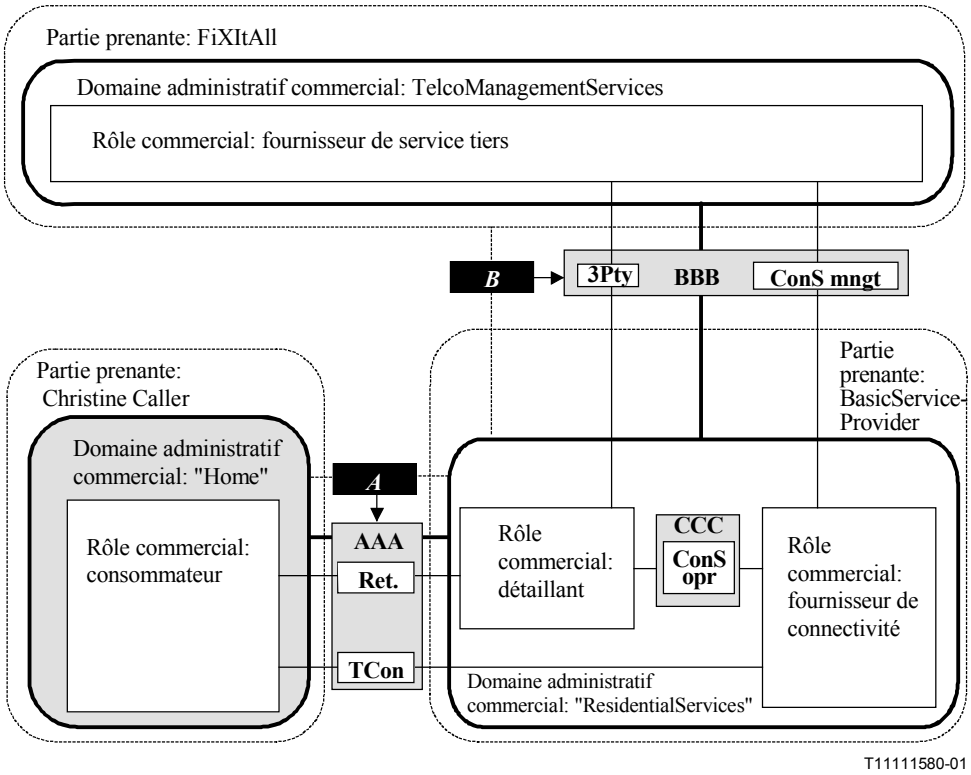

Figure II.4 – Example outsourcing of management

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