CONTRACTS FOR ATM SERVICES: A STRUCTURED ANALYSIS

J. McGibney, D. Morris, T. Curran

ABSTRACT: *In this paper we discuss the different kinds of contract that are required for the delivery of multi-service networks based on ATM. A growth in the number and complexity of such contracts is predicted and a need is identified for consistent terminology and structured analysis. We establish a framework in this paper for discussing, distinguishing between, and relating different kinds of ATM contracts. The idea of a session contract is introduced to refer to agreements relating to service usage. The impact of the value chain on such contracts is discussed and a categorisation of contract elements is proposed. Some observations are made about the possibilities for automated contract negotiation and implementation.*

1. INTRODUCTION

Contractual relationships between customers and providers of telecommunications services are becoming increasingly complex, due largely to changes in the marketplace and a growth in the number and complexity of services on offer. Market deregulation is providing customers with more choice and encouraging them to look for more in terms of quality of service guarantees. Furthermore, the flexibility afforded by multi-service networks based on asynchronous transfer mode (ATM) requires that contracts have elements that allow fair use of network resources and that protect the interests of both providers and customers. The development of increasingly complex charging schemes also necessitates that contracts become more elaborate.

In any marketplace, contracts are central to negotiations for product and service provision, and provide the basis for billing customers. This is especially true in a competitive telecommunications environment, where the contract is viewed as one of the most important tools available to service providers and customers. The fact that a charge can only be made where a contract exists, together with the existence of a rapidly growing service provision value chain, means that there will be a vast number of different kinds of service contracts. This value chain results mainly from market liberalisation and the expanding needs of users for more than just bit transport; there is an increasing tendency for organisations to look for "total solutions" to their telecommunications problems. Each link in this value chain will require a separate contract as a charge can only be made where there is a contract.

The emergence of technologies such as ATM that facilitate multi-service networks adds further to the number and complexity of service contracts. Such multi-service networks can allow the user a high degree of flexibility. Detailed agreements are needed to manage rights and obligations resulting from this flexibility; by the service provider to ensure fair and efficient use of network resources and by the customer to ensure that quality of service guarantees are met and that the bill contains no surprises. The ATM Traffic Contract [1] is designed to provide this kind of agreement at the level of a single connection.

The remainder of this paper contains a more detailed examination of contract issues, and is based on activities within the ACTS project, *CANCAN*, in the area of Service Contract Design. Further details of this work are available in [2]. The first step, presented in Section 2, is the establishment of a framework for discussing, distinguishing between, and relating different kinds of ATM contracts (i.e., service contracts,

The authors are with Teltec Ireland, Dublin City University, Dublin 9, Ireland.

usage contracts and traffic contracts). The idea of a session contract is introduced to refer to agreements relating to service usage. The contracts environment (i.e., the value chain) and contract elements are discussed in Section 3. In Section 4, some suggestions are made about automation of contract processes. Some brief conclusions are drawn in Section 5.

2. CONTRACTS FRAMEWORK

For reasons such as those outlined above, the relationships between customers and providers of ATM services can be quite complex. Such a relationship can be embodied by a multiplicity of different kinds of contracts over its lifetime. Such diverse arrangements as the provision of maintenance guarantees and the negotiation of traffic parameters for an individual connection, are variously described as "contracts". The contract governing the former may remain unchanged for a long time; on the other hand the traffic contract for an individual connection may be of a short term nature. The value chain, with resulting contract inter-dependencies, makes this picture even more confusing. Thus it is necessary to have a clear categorisation of types of contract, and a clear language for describing them.

We have identified for special consideration three broad types of contract, the *Provisioned Service Contract*, the *Session Contract*, and the *Traffic Contract*. These contracts are defined and described in more detail below. Note that these definitions include nothing about *duration* of the contract.

2.1. Provisioned service contract

A *provisioned service contract* is a commercial agreement between two parties relating to the provision of telecommunications services. This terminology draws on work of the RACE II Project, DESSERT[*] on service provisioning [3]. Here, a provisioned service is that which is purchased by a particular customer. A provisioned service implies an entitlement to use.

The negotiation of a provisioned service contract can be considered equivalent to *subscription*, although use of this term is declining as markets become more customer-focused. This type of contract specifies details of the service provided as well as the rights and obligations of the parties. These rights and obligations include those related to usage, although there will be a separate contract (the session contract) for each individual usage.

This definition of service contracts includes nothing about duration, though it is sometimes useful to distinguish between long-term and short-term service contracts. A long-term service contract is for the provisioning of telecoms services over a long period of time, say months or years, and is necessary for services (e.g. POTS) that require time-consuming and expensive provisioning which would not be economically justified for a short-term contract. A short-term provisioned service contract can be made possible by fast service provisioning. It is particularly suitable for supplementary services (e.g. call diversion), and such a contract would ideally be negotiable online. In the special case of single access to a service provider system, the short-term provisioned service contract may coincide in time with the session contract.

Service level agreement

Provision of telecoms service in a competitive environment will normally include negotiation of a *service level agreement* (SLA), usually consisting of a number of maintenance and other service guarantees. For analysis purposes, the SLA can be considered as part of the provisioned service contract, although it may constitute a separate physical document.

2.2. Session contract

A *session contract* is an agreement between a user and a provider for the duration of continuous usage of a service. Such a session could consist of several virtual path connections (VPCs) or virtual circuit connections (VCCs), and thus several traffic contracts.

---

[*] *De*cision *S*upport Systems for *Ser*vice Management, RACE Project R2021

The session is a very useful concept for charging in that it defines a usage entity that is mutually understood by the provider and customer. From a user point of view, a session should correspond to what he understands as a single "service usage", i.e., what would correspond to a single line on at itemised bill. Charging schemes involving usage components can then be structured in a consistent manner, independently of where we are in the value chain.

The session contract can be negotiated at whatever level of the service value chain is appropriate. At the ATM bearer service level, for example, a session might be equivalent to a connection, and the user is charged on this basis. As more value is added, however, it may be desirable to "hide" the details and charge the user on the basis of a session consisting of several connections, and perhaps some other elements.

It is useful to be clear on the distinction between a session and a *call*. A session can be considered equivalent to the traditional idea of a call for some services (e.g. a telephone or videophone call), but is defined more broadly and could represent, for example:

- a login session to an online service provider in which a number of different types of activity are included
- reading on the world-wide web a document that includes graphics or video clips
- a multi-party video conference in which a number of connections to different individuals are made and terminated as the conference goes on.

Thus usage of the term *session contract* is preferable to the term *call contract*.

In many cases, the session contract is not a contract in the strict sense of a negotiated commercial agreement; rather it is often implied at set-up, and is under the terms of the provisioned service contract. It can thus be viewed as the exercising of a right under the provisioned service contract. Furthermore, the session contract may coincide with a short-term provisioned service contract in some cases where no long-term arrangement exists, and the user just requires once-off access (with payment by credit card, for example).

2.3. Traffic contract

The traffic contract is a fairly mature concept in the ATM world and specifies an agreement relating to a single virtual path or virtual circuit connection. One or more such connections can be set up and released within a session, and it is possible that some connections exist just for a small period of time during such a session. As with the session contract, the traffic contract may be viewed in a sense as the exercising of a right under the provisioned service contract. Parameters of the Traffic Contract are defined in ITU-T Recommendation I.371 [1] and a detailed description is also given by the ATM Forum [4]. The possibility of re-negotiating such a contract within a single connection is discussed in CANCAN Deliverable 4 [5].

2.4. Relationship between these contracts

There is of course a close relationship between session contracts, traffic contracts and the governing provisioned service contract. As already mentioned, session contracts can often be *implied* at the set-up of a usage session. Likewise traffic contracts can be implied at connection set-up, the terms being dictated by the session contract, itself subject to the provisioned service contract.

Thus it is useful to consider these contracts as forming a hierarchical structure, with the lower-level contracts existing "within the terms of" those above. This structure is best illustrated with an example.

Example: Multimedia conferencing

Let us consider a multimedia teleconferencing service, provided by a value-added service provider (VASP) to small business customers. The VASP owns a bridge to which users connect as they wish. Each customer has a separate contract with the VASP, who also provides conference management. This multimedia service has video, audio, whiteboard, and data transfer components that individual users may access as required in a flexible manner.

Let us assume that the provisioned service contract is negotiated for a year. Within this year, the customer can set up as many conferences as he wishes. Multiple conference sessions may overlap in time if required. Within a given conference session, the customer has the flexibility to vary his configuration of video, audio, data transfer or whiteboard. The whiteboard may just be required for a short time, or he may

wish to drop out of the conference for some time to return later without the need to set up a new session. Alternatively, he may wish to alter his quality of service (QoS) settings during the session.

During the particular conference session illustrated in Figure 1, the user behaves as follows:
- audio: audio communication is maintained for the duration of the conference
- video: the user drops out for a time in the middle of the conference
- whiteboard: the whiteboard is used for a time at the start of the conference
- data transfer: two files are transferred to the user during the conference

The audio, video and whiteboard components are realised by setting up two VCCs, one for each direction. A single new VCC is set up for the duration of each file transfer.

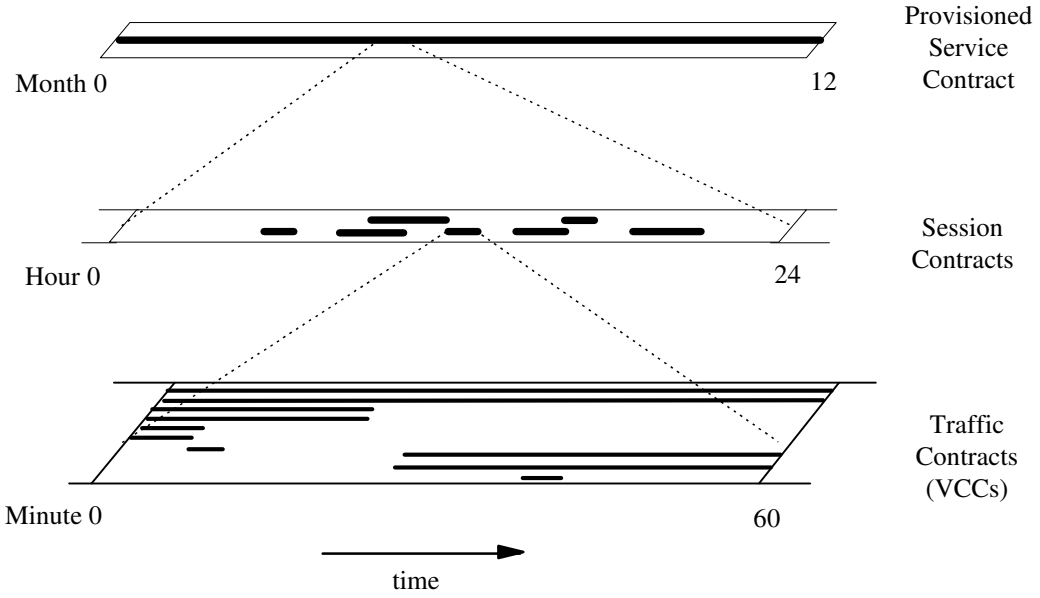

Figure 1: Mapping between contracts: an example

3. FILLING IN THE DETAILS

3.1. The contracts value chain

Each interface in the service value chain involves a commercial contract. A generic value chain is shown in Figure 2(a) below and contract interfaces are marked. In this value chain, each actor plays the role of customer to the level above and provider to the level below. Generally speaking, the most significant actors in this value chain are:

- end users (EUs)
- network operators (NOs)
- local loop operators (LLOs)
- private network operators (PrNOs)
- service providers (SPs)
- content providers (CPs).

In the example shown in Figure 2(b), the residential user's contract is with a VASP (e.g., for video on demand). The VASP, however, uses the facilities of a network operator (NO) to carry the service and has its own separate contract with the NO. It is important to distinguish these commercial interfaces from physical interconnections; in the example shown, physical interfaces can be expected to exist between the NO and the user and between the VASP and the NO.

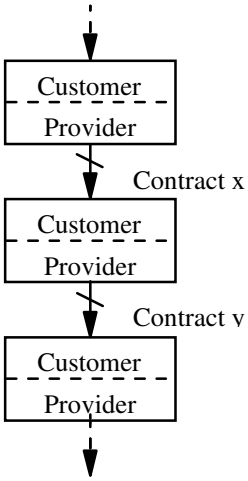

Figure 2(a): Generic value chain with contract interfaces

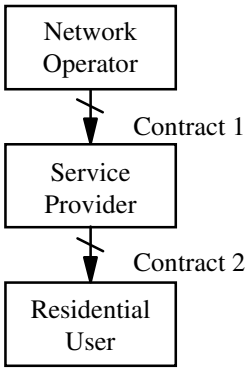

Figure 2(b): An example value chain

The existence of a value chain means that there are a significant number of dependencies between contracts that are, in a sense, "stacked" on top of one another. It is clear, for example, that a VASP can only provide video-conferencing of a certain quality to a customer if the underlying network infrastructure can support this. Translating QoS requirements between the layers of the value chain is one of the most important components of service contract design. The parameters of an customer's required QoS, which he may want embodied in a service contract, may be quite different from the objective measures that are specified in a traffic contract.

The design of service contracts requires consideration of several other contract elements as well as QoS, and these are discussed below.

3.2. Contract Parameters

The previous section showed that there are many different contracts in a multi-provider environment, both at the provisioned service and session levels, and at a variety of commercial and physical interfaces. This section considers what these contracts should generally contain. It is firstly necessary to establish categories of elements that are present in the majority of contracts. Within these categories, a listing of sub-categories is useful. The following are the principal categories of interest for all contracts, with relevant sub-categories:

- parties to the contract
- service (incorporating provisions of the SLA)
  - provisioned service
  - definition of usage (specifications for session and traffic contracts as appropriate)
  - special features
  - quality of service
  - restrictions
  - control and protection of the parties
- payment
  - tariffing arrangements
  - billing procedures
  - penalties and rebates
  - ease of auditing the above.

It is important to note that this categorisation only relates to those elements that have a clear impact on charging and automation technology. In reality, of course, service contracts contain other requirements relating to, for example, non-disclosure of the contract details, confidentiality of personal information and procedures for disputes.

4. A NOTE ON IMPLEMENTATION

It is important to give consideration to how the kinds of contract under discussion are agreed, and how this is subsequently implemented in the systems.

For the public switched telephony network (PSTN), the contract has traditionally been implemented in a number of (sometimes time-consuming and tedious) steps. Computer input forms part of this process and the remainder takes the form of papers issued to field personnel to carry out physical works. The level of automation in implementing the provisions of a contract varies between network providers. In some cases, paper replicas of the contract need to be circulated, a process that is both time consuming and prone to losses. By contrast, the most advanced systems enable the information to be entered only once.

Clearly the extra flexibility permitted with ATM can only be fully realised if automated, online contract negotiation and implementation procedures are available. At the level of the traffic contract, Connection Admission Control (CAC) and Usage Parameter Control (UPC) mechanisms are used for this purpose. Similar measures, though more difficult to standardise, are required at the level of the session contract to manage set-up requests and monitor usage. This thinking could also be extended to provisioned service contracts; indeed a demand can be envisaged for the provision of services on a once-off basis, requiring online negotiation and charging.

5. CONCLUSION

Contracts for ATM services is a new area of study and there is little published literature on the subject (traffic contracts are an exception to this). We have identified a number of issues in this paper that are worthy of investigation, and have presented results of our preliminary work on a contracts framework.

ACKNOWLEDGEMENTS

The authors wish to thank their fellow partners in the CANCAN* Consortium for helpful discussions about this work. The work of the CANCAN project is part-funded by the European Commission under the ACTS (Advanced Communications Technologies and Services) programme.

REFERENCES

[1] ITU-T Recommendation I.371 (draft), “Traffic Control and Congestion Control in B-ISDN”, ITU Study Group 13, Frozen Issue, Geneva, April 1996.

[2] ACTS Project AC014: CANCAN, “Techno-economic aspects of Contracts and ATM Charging I”, Deliverable 6, September 1996.

[3] "Service Provisioning in a Multi-Provider Environment", R Davison & P O'Brien, IS&N '94, Springer-Verlag, Lecture Notes in Computer Science Series, September 1994.

[4] The ATM Forum, “Traffic Management Specification”, version 4.0, April 1996.

[5] ACTS Project AC014: CANCAN, “Source Models for ATM Charging I”, Deliverable 4, August 1996.

* *C*ontr*a*ct *N*egotiation and *C*harging in *A*TM *N*etworks, ACTS Project AC014