A new approach to classify and describe telecommunication services

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Abstract

Service composition, especially the reusability of distributed Internet Protocol (IP) multimedia services, will play a decisive role in future telecommunication networks. Therefore present classifications and specifications for telecommunication services have been researched. The summarised results clearly illustrate the insufficiency of describing services from a consumer's view. So a new classification for telecommunication services is presented that will support customers to simplify the description of services. The aim of this approach is a simple specification and description language for reusable and distributed services which will support customers not only in describing services and service compositions. It should support customers to describe, find and use existing distributed telecommunication services.

Keywords

Multimedia, Value-added services, Service composition, Telecommunication

1. Introduction

Based on future networks, especially Next Generation Networks (NGN), and their service delivery platforms (SDP) the provision and composition of telecommunication services, also distributed telecommunication services, will be facilitated. In future customers will demand telecommunication services which will satisfy their requirements. To meet these increasing requirements, two of the critical steps are to implement the support for openness towards new services and to support the ability to describe services from a customer's view in future networks. This will lead to a number of challenges, such as classifying and characterising telecommunication services that will support customers to simplify the description of service compositions. Therefore present classifications and specifications for telecommunication services have been researched and are presented in the next chapter. The summarised results clearly illustrate the insufficiency of describing services from a consumer's view. A new classification for telecommunication services is presented in chapter 3 that will support customers to simplify the description of services. The aim of this approach is a simple specification and description language for reusable and distributed services which will support customers not only in describing services and service compositions. It should support customers to

describe, find and use existing distributed telecommunication services. Chapter 4 shows an example of a possible service description. Finally chapter 5 concludes the paper.

2. Existing definitions and classification models

Telecommunications (communications engineering) deals with capturing, processing, transmitting and storing information (communications). For this purpose telephony companies provide services (telecommunication services). The understanding of services differs in a broad range. The following lists different definitions and specifications for the notion of services in telecommunications.

- Services are functional properties of the network which support a certain form of communication between sources and sinks (P. Kühn, 1991).
- A service is a set of goods or valuable functions offered by a service provider to a customer (C. Abarca et al., 1997).
- An IP multimedia service is the user experience provided by one or more IP multimedia applications (ETSI TS 122.228, 2009).
- Services are made up of different service capability features (ETSI TS 122.105, 2008).
- A (Basic) telecommunication service is a term that is used as a common reference to both bearer services and teleservices (ETSI TS 122.105, 2008).
- IP multimedia services are the IP based session related services, including voice communications. IP multimedia sessions use IP bearer services provided by the PS (Packet Switched) CN (Core Network) Domain (ETSI TS 122.101, 2009).
- Multimedia services combine two or more media components (e.g. voice, audio, data, video, pictures) within one call. A multimedia service may involve several parties and connections (different parties may provide different media components) and therefore flexibility is required in order to add and delete both resources and parties (ETSI TS 122.101, 2009).
- Multimedia services are typically classified as interactive or distributed services (ETSI TS 122.101, 2009) (based on service classes specified by ITU-T (ITU-T Recommendation I.211, 1993)).

The listing above demonstrates that there are different meanings to services given by the standardisation bodies. They are basically divided into different bearer services. A bearer service is a type of service that provides the capability of transmission of signals between access points (ETSI TS 122.105, 2008). Bearer services are typically categorised by their information transfer characteristics, methods of accessing the service, interworking requirements (to other networks), and other general attributes. Information characteristics include data transfer rate, direction(s) of data flow, type of data transfer (circuit or packet) and other physical characteristics (Harte, J. et al, 1997). These bearer services are the basis for teleservices and supplementary services. A teleservice is a type of telecommunication service that provides the complete capability, including terminal equipment functions, for communication between users according to standardised protocols and transmission capabilities established by agreement between operators (ETSI TS 122.105, 2008). A supplementary service is a service which modifies or supplements a basic

telecommunication service. Consequently, it cannot be offered to a user as a standalone service. It shall be offered together with or in association with a basic telecommunication service (ETSI TS 122.105, 2008).

Based on these definitions a telecommunication service is a combination of a bearer service and a teleservice as shown in Table 1 (ETSI TS 122.001, 2009), (ITU-T Recommendation I.210, 1993).

telecommunication services	
teleservice	
basic teleservice	basic teleservice + supplementary service
bearer service	
basic bearer service	basic bearer service + supplementary service

Table 1: Categorisation of telecommunication services

There are two further definitions for services in telecommunications based on bearer services. These are the IP multimedia services and so-called value added (non-call related) services. The value added services include a large variety of different operator specific services/applications. They are usually not specified by 3rd Generation Partnership Project (3GPP). The services can be based on fully proprietary protocols or standardised protocols outside 3GPP (ETSI TS 122.101, 2009). Figure 1 gives an overview of all the described definitions.

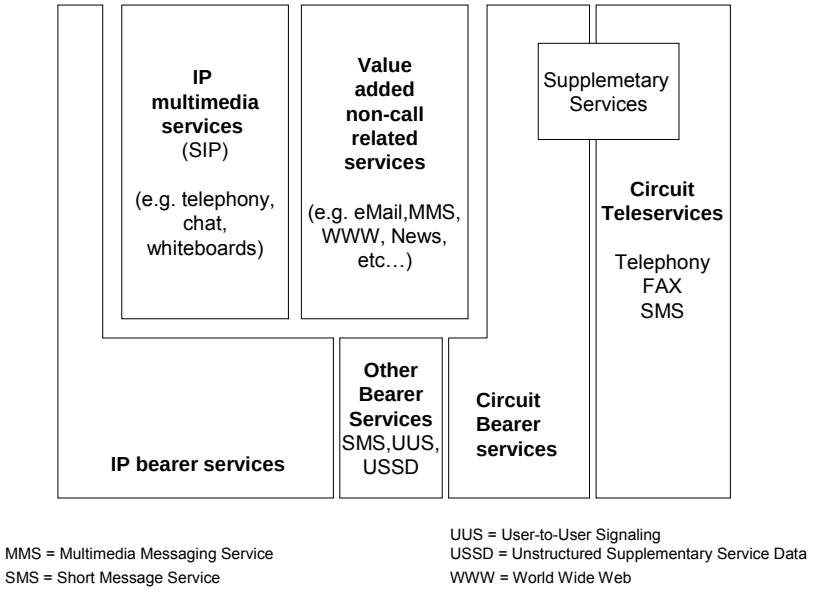

Figure 1: Service classification

The classification of services and applications is done according to ITU-T Recommendation I.211 (ITU-T Recommendation I.211, 1993), (Velez, J. et al,

2000). An (communication) application is defined as a task that requires communication of one or more information streams between two or more parties that are geographically separated. More specifically, an application can be characterised by the following main attributes (Kwok, T., 1995), (Velez, J. et al, 2000):

- intrinsic time dependency (time or non-time-based)
- delivery requirements (real-time or non-real-time)
- directionality (unidirectional or bi-directional)
- symmetry of the communication (symmetric or asymmetric)
- interactivity
- number of parties

A set of applications with similar characteristics, or even a single application, can be classified as a service. According to ITU-T I.211, services can be classified as interactive or distributed (ITU-T Recommendation I.211, 1993).

Interactive services are typically subdivided into conversational, messaging and retrieval services (ETSI TS 122.101, 2009):

- Conversational services are real time (no store and forward), usually bi-directional where low end to end delays and high degree of synchronisation between media components are required. Video telephony and video conferencing are typical conversational services.
- Messaging services offer user to user communication via store and forward units (mailbox or message handling devices). Messaging services might typically provide combined voice and text, audio and high-resolution images.
- Retrieval services enable a user to retrieve information stored in one or many information centres. The start at which an information sequence is sent by an information centre to the user is under control of the user. Each information centre accessed may provide a different media component, e.g. high resolution images, audio and general archival information.

Distributed services are typically subdivided into those providing user presentation control and those without user presentation control (ETSI TS 122.101, 2009):

- Those without user control are broadcast services where information is supplied by a central source and where the user can access the flow of information without any ability to control the start or order of presentation e.g. television or audio broadcast services.
- Those with user control are broadcast services where information is broadcast as a repetitive sequence and the ability to access sequence numbering allocated to frames of information enables the user to control the start and order of presentation of information.

Up to now services were classified in respect of providers or networks. This hinders differentiation of services, because they were not classified regarding to service components/media types (e.g. audio, video, data) but rather in dependency to the needed resources. The problem of classifying services by the presented methods is that there is no chance to link up services. The next chapter presents a new method to classify services in telecommunications, which will allow services to be concatenated.

3. New approach to classify multimedia services

Services in telecommunications always offer different media and data. Media is generally known as "A general term of means and techniques for spreading information (incl. entertainment, music et al.)" (Meyers Großes Taschenlexikon, 1987). Media consists of different media types. These media types are divided into media perception and media presentation.

Media perception describes the modality of how humans will conceive information. The information humans may conceive are joint to their sensory perception. Therefore only the physiological perception is considered and no subjective or other natured scoring. Examples of acoustic media are music, speech and sound. Visual media are text, still image or video. The presentation of media belongs to the processing of information e.g. the encoding of video (Boles, D. et al., 1996).

A media type will be described through its presentation and perception of media. It will be named by its media perception (e.g. audio, video, text). Media types can be time-invariant or continuously. Time-invariant media types are for example text and still image and continuous media types are for example audio, video, animation (Boles, D. et al., 1996). The data of multimedia can be processed by the following components:

- Sources output data streams of concrete media types.
- Sinks receive data streams and they can potentially display them.
- Filters combine the characteristics of sources and sinks. Filters are mostly used to convert data streams (e.g. mono-to-stereo).

These three components are called media objects. All media objects are connected by media channels/ports which belong to one media type. These ports represent the I/O-interfaces of a media object. Figure 2 shows an overview of the media objects.

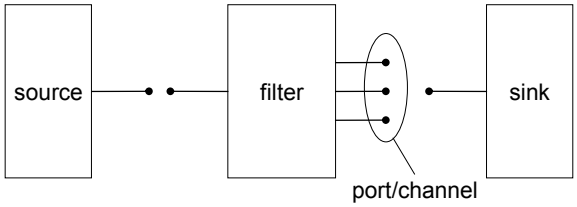

Figure 2: Media objects

These elements are well known from telecommunications. In the near future telecommunication services will support more media types, which can be derived from the human senses. All five senses are shown in the following listing.

- Auditiv (Hearing)
- Visual (Sight)
- Gustatory (Taste)
- Olfactory (Smell)
- Haptic (Touch)

Four further senses (pain, balance, proprioception and temperature) are known, which will be assigned to the sense touch, only for simplification. Furthermore there are also media types which are not sensually imperceptible. These media types can only be processed by machines. Following they will simply be called data. Consequently there are six different media types. They could be characterised more precisely (e.g. Hearing: Audio, Speech or Sound). Table 2 gives an overview of the media types and some of their possible characteristics.

Media type	**Characteristics**
Hearing	sound, speech, music
Sight	video, animation, text, still image, light
Taste	sweet, sour, bitter, spicy, umami
Smell	camphorous, fishy, malty, minty, musky, spermous, sweaty, urinous
Touch	pressure, temperature, balance, proprioceptive
Data	file, sensor, actuator, trigger, information

Table 2: Media types and their characteristics

The shown classification of media objects and types creates a possibility to describe compositions of multimedia streams. Media compositions are divided into the three type's spatial, temporal and configurable compositions (Steinmetz, R., 1993). Spatial composition describes the geometrical structure of the presentation of the media and will not describe the way a service should works. The configurable composition describes dynamic connections between the single media objects (e.g. how text has to be converted into speech) and the temporal composition describes temporal relations of the media objects. The relevant media composition for telecommunication services is the temporal composition combined with a configurable composition called service function (see Figure 7). According to Allen (Allen, James F., 1983) relations between two intervals can be divided into 13 different relations. Figure 3 shows seven of them. All other relations result in inverted relations. The only relation without inversion is "equals". All these relations could also be described by a hierarchy (see Figure 4 for an example).

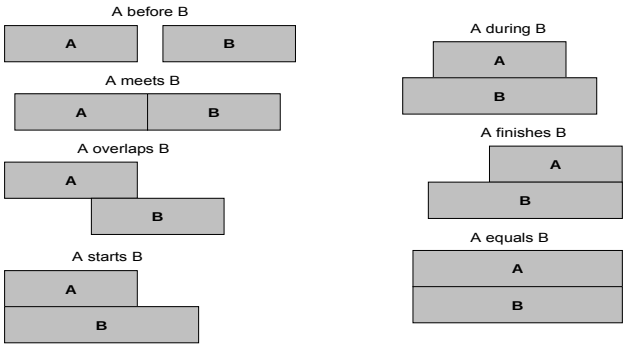

Figure 3: The thirteen possible relationships

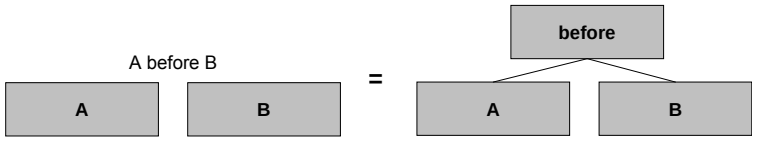

Figure 4: Transformation to hierarchical representation

With the presented methods it is still possible to describe multimedia services. But this description is very vague. To specify the description the media objects which are bound to media types, which maybe specified by their characteristics, are extended with inner methods. The inner methods are derived from the possible basic connection types in telecommunications (see Figure 5).

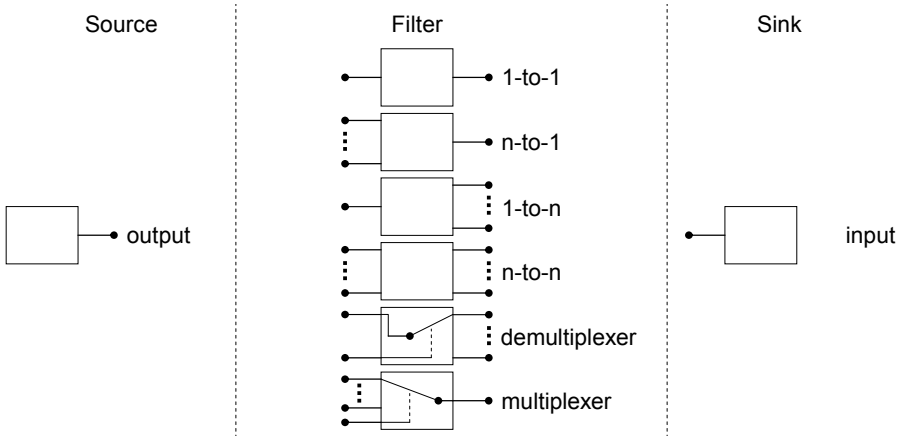

Figure 5: Basic types of media objects

The shown basic types of the filter elements are sorted into three groups, intra-media, inter-media and special types. The intra-media filters will only process one media type. Handling of different media types will be processed by the inter-media filters. The special types can be used inter or intra media. Figure 6 presents an overview of the different filter types.

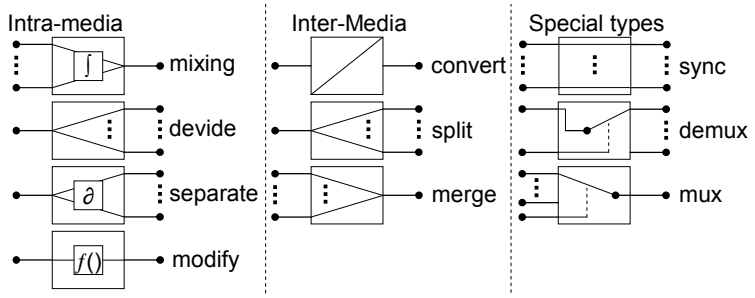

Figure 6: Filter types

The next chapter will give you an impression of how to describe telecommunication services by using the defined elements and methods presented in this chapter.

4. Exemplary service description

The following example describes a simple service scenario. Some information (e.g. the identity of a subscriber) will be displayed to another subscriber, if the information matches to a simple result of a function (e.g. the initiating subscriber's name is "bob"). Afterwards the two subscribers may have a multimedia session to communicate with each other (e.g. audio and video telephony). How could this simple service be abstracted by the usage of the elements and methods presented in the previous chapter?

First it is essential to distinguish two different types of descriptions. The first one is the service function description and the second is the temporal service composition description. Both are shown in Figure 7.

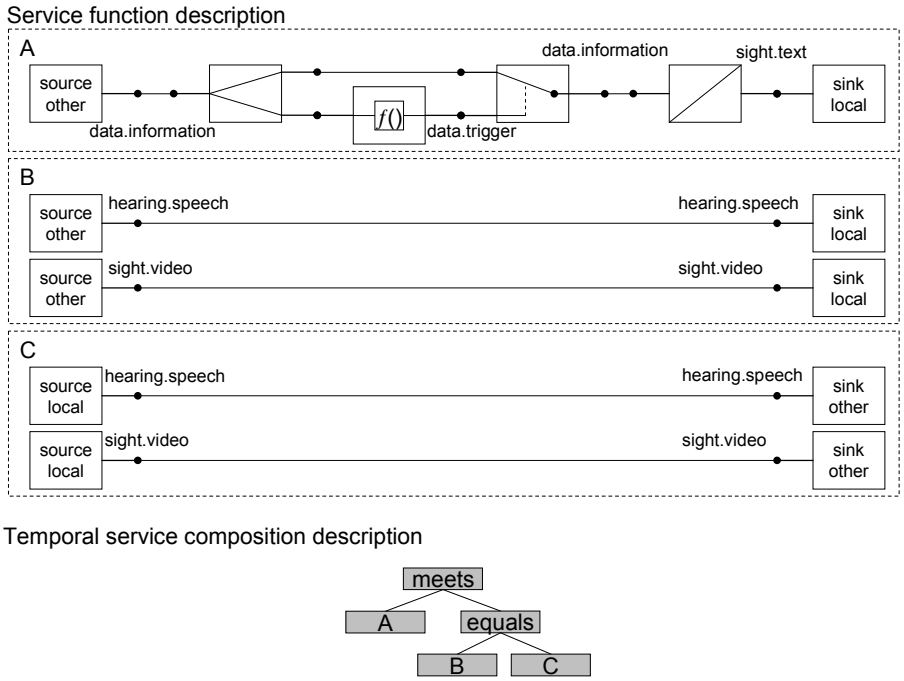

Figure 7: Exemplary service description

The service function description in Figure 7 depicts three different service functionalities. The first one "A" is the functionality which describes that some information is transmitted and converted to text, if the information triggers the media stream containing the information. The descriptions "B" and "C" describe two media streams, namely speech and video. All three functional descriptions are temporarily composed by the hierarchical tree in Figure 7. This can be transformed to the following view according to Allen (Allen, James F., 1983) (see Figure 8). Figure 8

clearly depicts clearly that the functionality "A" is followed by "B" and "C" and that "B" and "C" will exist for exactly the same time.

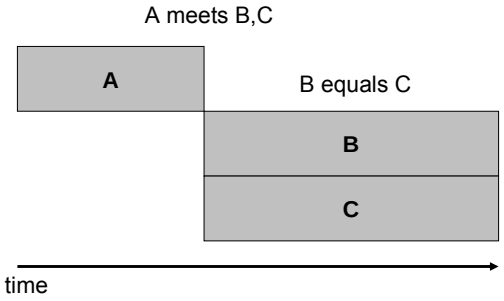

Figure 8: Temporal description with timeline

5. Conclusion

The presented classification for telecommunication services illustrates that service description and composition could be handled easily. The new classification provides tools to support customers to describe telecommunication services themselves. The created service description could also be transformed into a technical representation such as the extensible markup language (XML). The shown model is as well extendable, e.g. the inner methods of the filter types could be more specified (e.g. modify.loudness).

The next steps to be taken are the verification of the presented model and a conversion into a technical representation (e.g. XML). Also the attempt to convert the technical representation to a mathematical correspondent is planned to make the entire model may be provable.

6. Annotation

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