INTERCONNECTION OF MULTIMEDIA SERVICE NETWORKS

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There are a number of emerging services that build, in addition to the traditional voice component, on new media elements as e.g. text, photos, videos etc. In order to improve exploitation of these new revenue opportunities it needs to be ensured that these services can also be used in inter-network scenarios, i.e. network domain boundaries.

This work describes the various technical areas that need to be considered for network interconnection for Multimedia services. The work also highlights a number of critical issues that are expected to occur during interconnection deployment, which result from gaps in current standard's specifications. As a result of the investigations done in this work a number of requirements for the interconnection of MM (Multimedia) services have been identified.

The interconnection of IP networks based on the work done to date is likely to suffer from:

- *non-guarantied QoS,*
- *security risks,*
- *inefficient use of network resources,*
- *interworking achieved only by bilateral agreements on a case-by-case basis.*

This will prevent or at least impede interoperability of many services, thus making it impossible to offer them as a service spanning more then one operator network. The interoperability of MM services in the context of sustainable business models can only be solved by defining the technical requirements for interconnection, leading to standardisation.

This work introduces an approach for optimally definition of these requirements in order to find the best way for realisation of fully functioning interconnected networks.

Keywords: Multimedia services, Interconnection, IP networks, Management, Quality of Services

1. INTRODUCTION

1.1 Background

The interconnection of IP (Internet Protocol) based networks providing Multimedia services, has not been given adequate consideration from the perspective of the telecommunication operators. The interconnection of IP networks based on the work done to date is likely to suffer from:

- Non-guarantied QoS (Quality of services);
- Security risks;
- Inefficient use of network resources;
- Interworking achieved only by bilateral agreements on a case-by-case basis.

This will prevent or at least impede interoperability of many services, thus making it impossible to offer them as a service spanning more then one operator network. Due to the declining revenues from traditional voice services, new type of services built upon new media elements – images, videos etc., will increasingly contribute to the revenues of operators. In order to improve exploration of these new revenue opportunities it needs to be ensured that these services can also be used in internetwork scenarios.

One possible example for such situation is that a user in one network should be able to setup MM service with another user in another network, both networks are located in one country. This might be estimated to be the major application case of interconnection. A second example should be the interconnection between users where the related networks are in different countries. This scenario will, due to the increased mobility of people, be of increasing importance.

The interoperability of MM services in the context of sustainable business models can only be solved with defining the technical requirements for interconnecting, leading to standardisation.

1.2 The approach

During the consideration the areas of concern related to interconnection of MM service networks were identified:

- Architectural framework and business rational,
- Signalling,
- Media,
- Management,
- Numbering, Naming and Addressing,
- Transport functionality (including physical interconnect).

For each one of the above areas the available relevant standards that address interconnection issues have to be identified and analysed. This will show to what extent issues of interconnection are already covered by standardisation. The outcome will have to be compared with the full set of requirements that have to be met in interconnection scenarios. One of the results of this work will identify the areas that are not sufficiently addressed yet by standardisation.

In consequence of the limited volume of this paper the author decided to limit the scope of the initial activities to covering the requirements and issues for the voice component of a Multimedia Interconnect.

2. ARCHITECTURAL FRAMEWORK

2.1 Interconnection scenarios

In a basic scenario interconnection means the connection between two networks

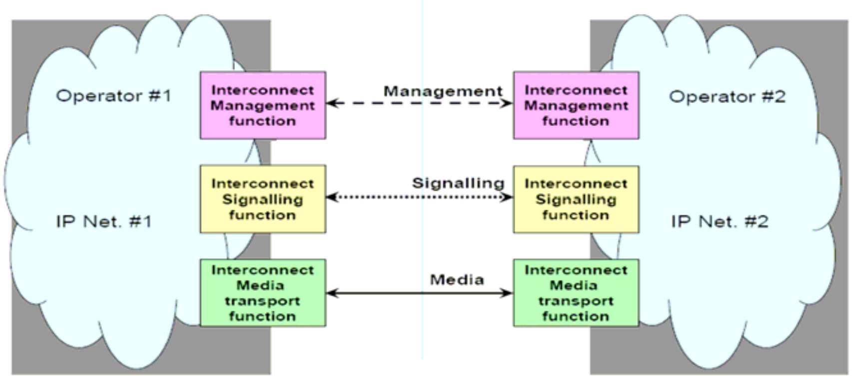

Fig. 1 Direct interconnection of two networks

(Fig. 1). Interconnection needs to be considered in three areas: Interconnection at the management plane, at the control plane, and interconnection at the transport plane. The control plane includes all aspects of service set up and control, including signalling. The transport plane includes the mechanisms for the transfer of service usage data (media) including embedded OAM (Operation, Administration and Maintenance) flows. The management plane handles management (OAM) tasks.

In many cases the two networks to be interconnected will physically not be adjacent. Thus there is the need to involve a third operator to transit (Fig. 2). The functionality required at the transit operator will be different from those at the originating or terminating operator.

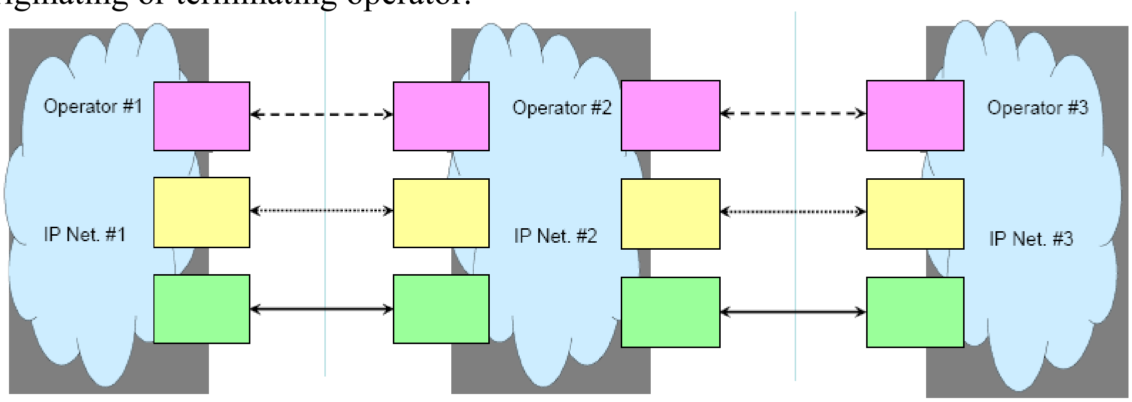

Fig. 2 Three networks scenario

2.2 Architectural framework

There are three types of information flows between interconnected networks considered here:

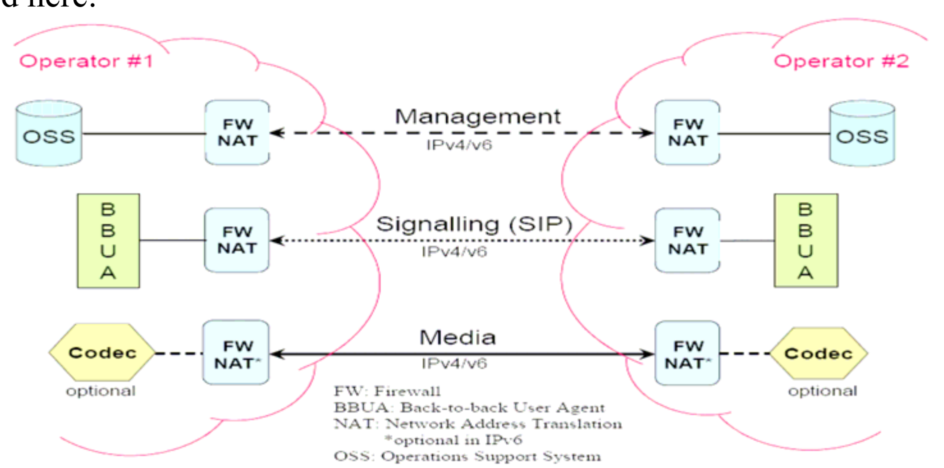

Fig. 3 Architectural framework of the interconnection

- Management information flow: related for network and overall service management, not for service sessions;
- Signalling information flow: related to the control of specific services sessions and related capabilities;
- Media information flow: user data of the specific service.

Figure 3 represents the architectural framework of the interconnection between the networks. The most common functions and entities are shown at the places they are located in both networks. The set of these functions builds the overall entrance point of each network.

2.3 Relation to standardisation bodies work: 3GPP's, IMS, ITU-T and NGN architectures

Within ETSI (European Telecommunications Standardisation Institute) [1] and the ITU (International Telecommunication Union) [2] the understanding is that the NGN (Next Generation Networks) architecture would be based upon the work progressed in 3GPP (3rd Generation Partnership Project) [3] e.g. IP Multimedia Subsystem (IMS) architecture. The benefits being that we don't and want to reinvent the wheel when 3GPP have done the work. This should also help with the long-term goal of fixed/mobile network convergence.

After analysing the IMS architecture with respect to possible architectures for NGN it was concluded that the main differences lies in the access, i.e. the radio interface verses the DSL (Digital Subscriber Line) interface, and not in the core network. As the work undertaken here is on the interconnection of two networks, i.e. in the core, the results should be applicable to both the 3G and NGN architecture.

3. TECHNICAL RULES RELEVANT FOR INTERCONNECTION

3.1 Signalling

In this part of the work a short analysis of the requirements of the signalling for interconnecting two or more NGN networks is made.

Signalling Protocols for a VoIP (Voice over IP) service

SIP (Session Initiation Protocol) [1] is a protocol that has been designed for end-to-end applications that are capable of communicating over IP. It has been chosen as the main protocol for the 3GPP IMS architecture to base the NGN upon the work in the 3GPP forum.

The main issue of this protocol is that it has problems when addressing NAT and Firewalls. This problem is starting to be recognised and worked on in the IETF (Internet Engineering Task Force) along with the development of NSIS (Next Steps in Signalling) protocol could be deployed with SIP.

Quality of Services of Call control Signalling

If the traffic engineering for the interconnection of the signalling link is such that the maximum bandwidth is provided, then it could be argued that a specific QoS mechanism is not required. QoS is required and should be configured on a link-by-link basis by management systems or accomplished at the lower layer by MPLS (Multi-Protocol Label Switching). An admission control system similar to the admission control on the access could also be deployed. No clear information on how this can be accomplished is available from the standard bodies this requirement needs further study.

Security for interconnect Signalling

Security between the operators is not the same as between operators and the Internet. For security on signalling for the inter-office scenario, is probably justified although it is more problematic on the intra-office scenario. As the signalling is being tunnelled by MPLS then the use of a further tunnelling protocol for security was considered to be a tunnel to far, which then leaves the choice for security as IPsec.

3.2 Media

New Telecom applications will rely on customised services, they will be highly flexible and easy to manage and they will integrate Telecommunications and Information Technologies. Parts of the service components will be voice components that need to be handled in order to guarantee an end-to-end Quality of Service at a predefined level.

As part of the current work aspects with respect to speech quality as well as the representation formats of the several speech codec's in use and their mapping into IP-based protocols were analysed. The main QoS parameters for an overall transmission Quality for Services that contains voice component are described in [4]. These are the overall transmission rating, the end-to-end speech quality and the end-to-end delay. The requirements for these three parameters are specified in [5]. ETSI does not give a definite assignment of a certain speech codec to a certain speech class. As a result of the current work an assignment as specified in Table 1 is taken.

Speech QoS class	Wideband	Narrowband		
	3	2H (High)	2M (Medium)	2A (Acceptable)
Speech codec	G.722.1 G.722.2	G.711	G.726 G.729	G.723.1
Overall Transmission Rating	Under study	>80	>70	>50

Table 1: Assignment of speech codec's and rating to speech QoS classes

3.3 Management

In order to analyse needs regarding Management and correspondingly to specify requirements, two main aspects are taken in consideration: management functionality and interfaces needed. This has led to a development of a management model which will be presented in a future work. Here only the main topics of the aspects will be shown.

Functionality: SLA conformance reporting, Traffic reporting, Routing management, Accounting, Consistent QoS/CoS (Class of Services) marking, Management of inter-office interconnect tunnels;

Interfaces: There are many types of interfaces defined – between Service Providers, between Network operators, between Transport Network Operators and between all of them.

3.4 Numbering, Naming and Addressing

A wide consideration of the numbering, naming and addressing is being made in [6]. Large number of requirements and concrete proposals are also given. Here an extraction of the results in [6] is shown (Table 2).

Equipment	External address visible at the interface	Internal address within the operator
Terminal	Public IPv4 or IPv6	Public or Private IPv4 or IPv6
Signalling (B2BUA)	Public IPv4	Public or Private IPv4
OSS(Management)	Public IPv4	Private IPv4
IP Router (Media)	Public IPv4	Public or Private IPv4

Table 2: Possible choices for the addressing between two operators

4. CONCLUSIONS

As a result of the investigation done in this work a number of requirements for the interconnection of MM services networks have being identified. This list is not complete, but rather as to give an overview of the major requirements:

- Layer 3 differentiation between Media, Signalling and Media Flows,
- Priority to be given to the intra office-scenario,
- Should the inter-office interconnect scenario be viable, MPLS shall be used,
- Support for both IPv6 and IPv4,
- The signalling protocol shall be SIP,
- Codec negotiation is required,
- RTP (Real Time Protocol) to be used for all voice services,
- Routing advertisement is not required between network operators,
- Firewall functionality is required under control of BBUA and Management.

The next steps of the investigation may be defined as follows: Consolidation of the architecture proposed for QoS IP telephony-based services with a specific attention to a SIP profile definition dedicated for interconnection; Taking into account the services including video media component and extend the IP telephony services with ISP based; Covering other MM services (presence services, Push@talk etc.)

5. REFERENCES

[1] IETF RFC 3261 SIP: Session Initiation Protocol

[2] Y.NGN-Overview (ITU-T SG13): General overview of NGN functions and characteristics, COM 13-R 46

[3] 23.002 3GPP TS 23.002 v6.4.0 (2004-3): 3rd Generation Partnership Project, Network Architecture (Release 6), http://www.3gpp.org/ftp/Specs/archive/23_series/23.002/23002-640.zip

[4] ETSI TR 101 329-1: Telecommunications and Internet Protocol Harmonisation Over Networks, Part 1: General aspects of Quality of services (QoS)

[5] ETSI TR 101 329-2: Telecommunications and Internet Protocol Harmonisation Over Networks, Part 2: Definition of speech Quality of services (QoS) classes

[6] Investigation and analysis of the identification forms and methods in the telecommunication networks - numbering, naming and addressing, Scientific contract 86/2002 ICT Agency - Bulgaria, Technical University of Sofia, 2002