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Bundling in the Area of Telecommunications in Bosnia and Herzegovina

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***Abstract*— When one company sells two or more separate products in a package for a single price, it is called "bundling". In this paper, it is described bundling in telecommunications area as a way which is used in Bosnia and Herzegovina by all operators with basic goal to keep existing users and increases average revenue per user. In this paper, it is described, as a case study, one operator network for realization triple play and quadruple play package and services which is used in that packages. It is pointed to actual architecture of the network for realization uniform service delivery, IP Multimedia Subsystem.**

***Index Terms*— Bundling, Triple Play, Quadruple Play and IMS**

I. INTRODUCTION

BUNDLING is used in many area of today lives. First example is purchasing in fast food restaurant. In McDonald's consumers can buy Big Mac menu with large soft drink, large French fries and double cheeseburger for single price or consumer can buy all of that products for individual prices, but in that way it is more expensive.

Second example is selling a lot of parts of software on the single price, like Windows Office which is consists of many different programs in one package.

But, in this paper we are concentrated only to bundling in area of telecommunications in one country, Bosnia and Herzegovina (BiH).

II. WHY BUNDLING

There are two basic reasons [1] why a subscriber may choose to purchase a bundle:

1. Operator may decide to offer only bundling and in this case it is only solution for the subscribers.
2. Bundling is cost saving for subscribers, because it is cheaper to buy packet of the service than to buy individual service.

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From the point of view of the operator, revenue from services like fixed telephony is constantly decreasing, and forming package with more promising services (like IPTV, VoD) with less promising (like fixed telephony) is one way to increase average revenue per user (ARPU).

There are two types of bundling: pure bundling and mixed bundling, [1].

"Pure bundling" is case in which operator offers to subscriber (end users) package of services at a single price and in that case subscribers haven't impact on the package's performance.

"Mixed bundling" is case in which subscribers may to choose some individual service from package (collection of services) and subscribers have possibility to choose some performances of services, like data flow, prices and so on.

Communications Regulatory Agency (CRA) in BiH collects data from the operators and performs their processing and analysis. There are three operators with significant market power (based on „Official Gazette of BiH", No 73/12 from September 18th 2012): BH Telecom, M: TEL and HT Mostar, [2].

Table 1: Number of users per package of the services in BiH (for all operators)

Double play package	2011	2012	2013
IPTV and Internet	45.494	36.59	61.204
Fixed telephony and Internet	17.523	22.985	25.511
Fixed telephony and IPTV	25.823	42.555	58.375
Triple play package			
Fixed telephony, Internet and IPTV	30.94	61.176	96.574
Quadruple play package			
Fixed telephony, Internet, IPTV and mobile telephony	864	999	3.052

In Table 1 and Table 2 is used data from Annual Report of the CRA for 2013 year [2].

In Table 1 is given number of subscribers per packages of services in BiH for all operators.

In Table 2 is shown number of subscribers per collections of services in BiH for all operators.

Table 2: Number of subscribers per collections of services

Two services	2011	2012	2013
IPTV and Internet	42.844	77.789	68.371
Fixed telephony and IPTV	495	762	1.1281
Three services			
Fixed telephony, Internet and IPTV	160	142	207

III. TRIPLE PLAY PACKAGE

Triple play package in telecommunications is a marketing designation for offering services: broadband access to Internet, VoIP (now only in the form IP Centrex service for business consumers) and IPTV over single broadband access, [3]-[5].

Introduction triple play package provides benefits for operators and subscribers.

Triple play benefits for operators are:

- Operators offer integrated services: video (IPTV and VoD), data and VoIP (in form of IP Centrex) over single network based on Internet protocol (IP).
- Using single network for all services leads to lower costs as compared to the case when using separate network for each service.

Triple play benefits for subscribers:

- Pictures with better quality than the existing and possibility to introduce new services like video on demand (VoD), electronic program guide (EPG) with broader possibility than classical TV remote control, time shifted TV and so on.
- Flat data flow (unlimited possibility of download/upload data).
- It is expected that VoIP (as cheaper way of voice communications) has quality comparable to, if not better, than traditional telephony, because it is realized in closed environment of one operator with defined quality (QoS-Quality of Services).

In Fig 1 is described network for realization triple play service (case study, M: TEL network). It is described broader in [3]-[5].

It is important to emphasize that the end users have possibility to decide to use just some of the services from that package (as shown in Table 2).

A Triple play in the M:TEL network, case study

In Table 3 are shown triple play packages in M.TEL network and from table is obvious which capacity access network need to have for realization that services, [3]-[5].

Table 3: Triple play package in M:TEL network

TRIPLE PLAY PACKAGE		CAPACITY IN ACCESS NETWORK	
Broadband access to Internet	ADSL package in M:TEL network	ADSL package	Speed of download/upload (kbit/s)
		HOBBY	1536/192
		OPTIMA	3584/320
		OPTIMA+	6144/448
		EXPERT	10240/640
IPTV channel	Standard definition channel	MPEG 2 coding	3,8 Mbit/s
		MPEG 4 coding	1,8 Mbit/s
	Hard definition channel	MPEG 2 coding	19 Mbit/s
		MPEG 4 coding	6-8 Mbit/s
VoIP codec and voice compression algorithm	G-711/PCM		64
	G.726/ADPCM		16,24,32
	G.728/LDCELP		16
	G.729/CS ACELP		8
	G.723.1/MP-MLQ		6.3

Triple play services: broadband access to Internet, IPTV and IP Centrex are transmitting as individual flow from xDSL (Digital Subscriber Line) modem to DSLAM (Digital Signal Access Multiplexer) using ATM (Asynchronous Transfer Mode) protocol. Each services has own ATM's VPI/VCI (Virtual Path Identifier/Virtual Channel Identifier) number which is mapping on DSLAM/MSAN (Multi Service Access Node) in adequate VLAN (Virtual Local Area Network) for transmitting across IP/MPLS (Multi Protocol Label Switching) backbone network.

All services from triple play package have own platform:

- Broadband access to Internet has ISP platform and BRAS server (Broadband Remote Access Server)
- IPTV has IPTV platform

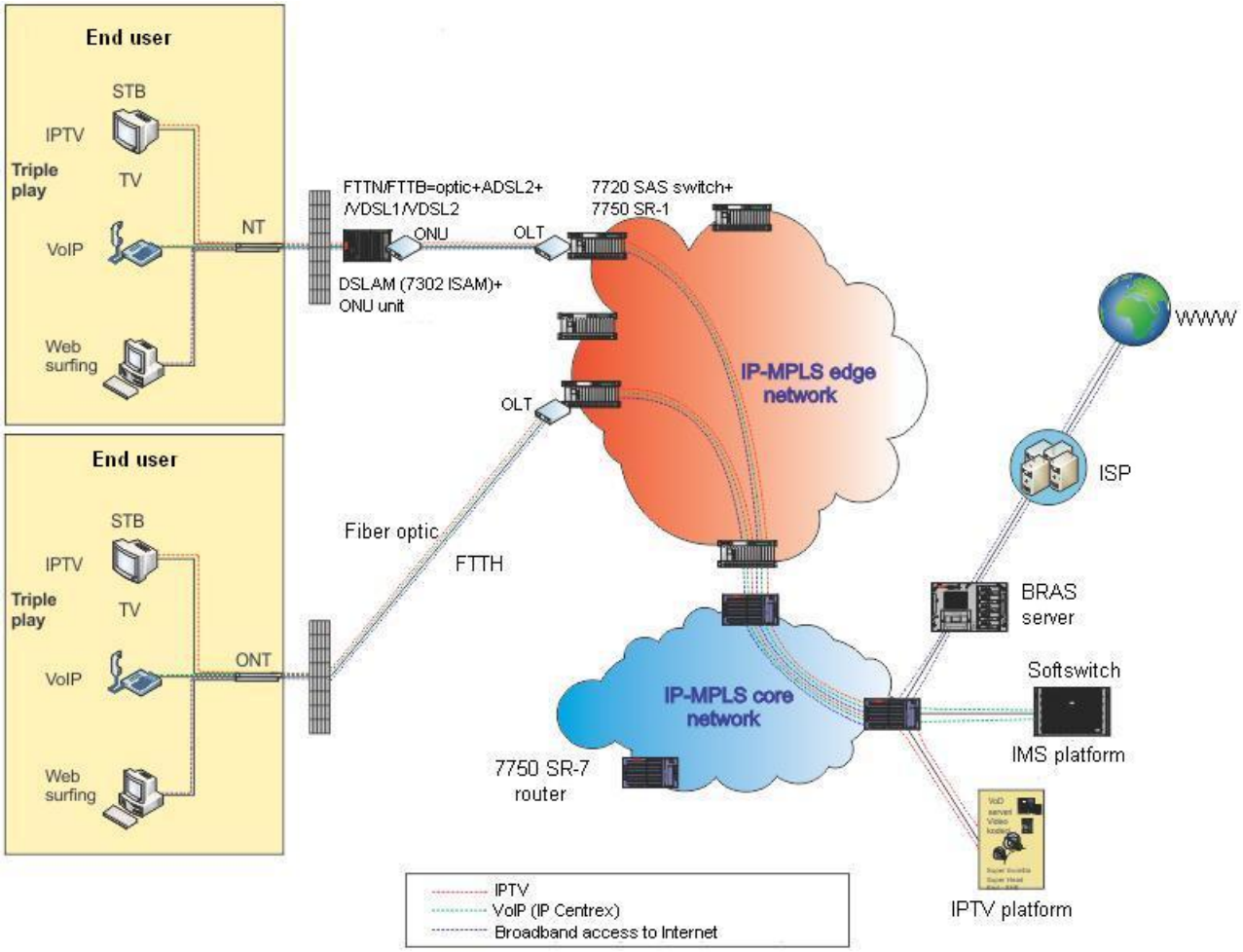

Fig. 1: Network for realization triple play services (a case study of the M: TEL network)

- IP Centrex is realized across Huawei IMS (IP Multimedia Subsystem) platform.

Adequate throughput of the access network (capacity of the access network) is equal to sum of the capacity of the all individual services from the triple play package, [6].

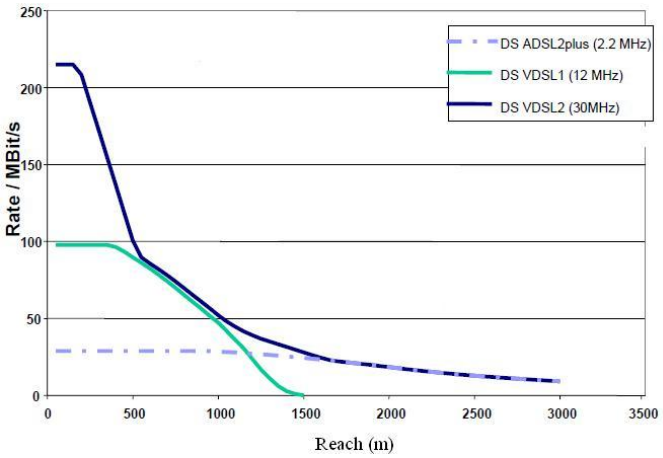

Fig. 2: Dependence of data flow from distance

It can be concluded that the capacity in the access network may be bottleneck for the realization triple play concept and it can be used different solutions [6]-[7] for solving this problem:

- In access network can be used xDSL technology with very high capacity (ADSL2+, VDSL1 and VDSL2) but in the small distance from the DSLAM (Fig. 1 and Fig. 2)
- It can be used some of the next models too (Fig. 1):
  - FTTN (Fiber to the Node): combination ADSL2+, VDSL and VDSL2 with fiber optic. In this case, DSLAM must be located 1km from the end user.
  - FTTB (Fiber to the Building): DSLAM is located in the building with very short distance from the end user
  - FTTH (Fiber to the Home): fiber optic to the end user.

It is considered GPON (Gigabit Passive Optical Network) as ideal solution for realization triple play concept. GPON has capacity of about 2.5 Gbit/s for download and 1.25 Gbit/s for upload for the distance of the 20 km.

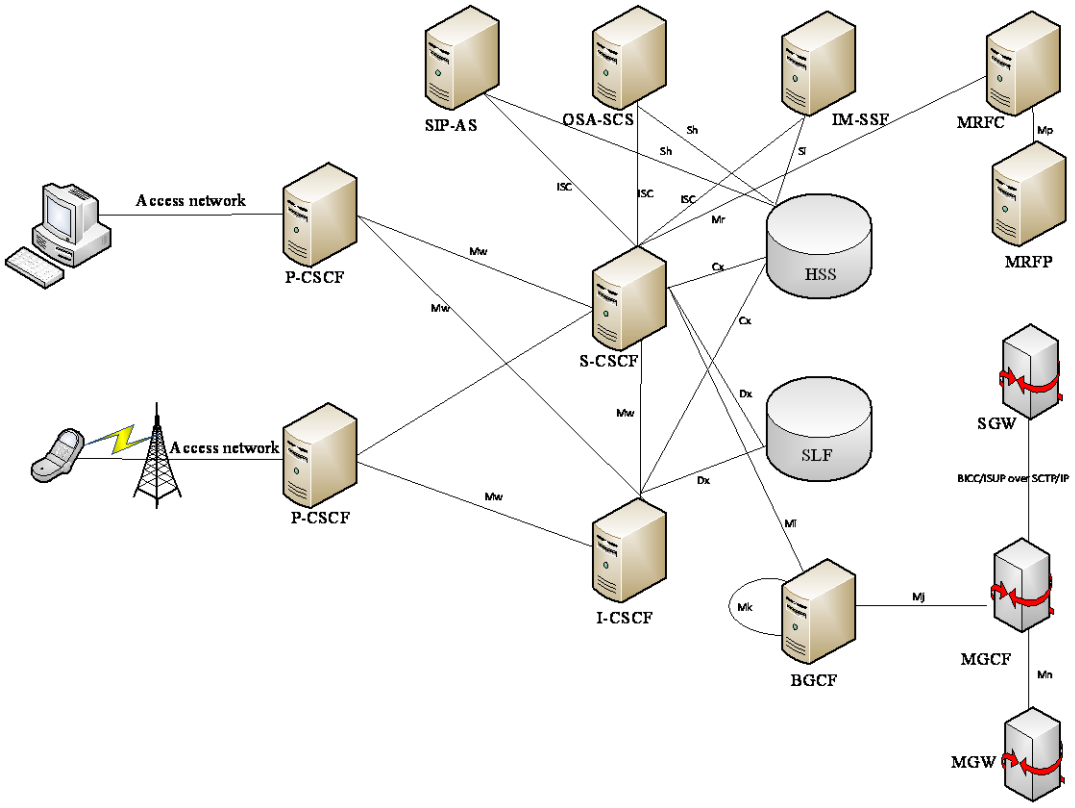

Fig. 3: 3GPP IMS Architecture

IV. QUADRUPLE PLAY PACKAGE

Quadruple play means: services from triple play package plus wireless accessibility into one package. Uniformed service delivery is a key requirement for quadruple play. Like triple play, end users may to decide to use some of the service from quadruple play package.

Network architecture for uniform service delivery must to unified identification each subscriber for the purpose of authentication, authorization, accounting (AAA) and delivery of services across different access network (service continuity across different network).

Building network architecture for that is not trivial task. Today, it is considered that the introduction IP Multimedia Subsystem (IMS) is the best solution, [8].

Basic principles of IMS architecture are set in Release 5 by 3GPP Standard Organization. IMS is originally developed only for mobile networks. In Release 6 and 7 is enabled networking with other wireless network, like WLAN (Wireless LAN) and WiMAX (Worldwide Interoperability for Microwave Access) and access to IMS from the fixed network. That means that it is made fixed-mobile convergence. It is main trend in telecommunication industry from 2005 year.

Subscribers are moving between different networks and they have possibility to access to all registered services and applications regardless of the access technology, because IMS enables uniform subscriber identity mechanism independent of the underlying network.

But, it must be taken into consideration that, when subscriber moved from one network to another with different capacity, some performances of the services can be degraded.

It can be seen from Fig. 2 that subscriber can access to IMS over fixed network (xDSL, Ethernet, cable network) or over the mobile network (W-CDMA, GPRS, GSM...) or wireless network (WLAN, WiMAX). IP Multimedia Susystem crossed boundaries between mobile wireless and fixed line technologies, [9].

Communication with plain old telephone system (POTS) is made by gateway. Only requirement is using IPv6 protocol.

One of the biggest problems for the realization uniform service delivery is to provide satisfactory security across different network, [10] because, as mention earlier, IMS may work over the different access network and some of them have lower security than other and IMS infrastructure is based on standardized and open technologies (SIP, Diameter).

In Fig. 2 is presented 3GPP IMS architecture [8]-[11]. In this architecture is made separation between service and control and between call control and media transmission.

Basic elements of the IMS architecture (from Fig. 3) are:

- CSCF (Call Session Control Function) which is consist of P-CSCF, I-CSCF and S-CSCF

- P-CSCF (Proxy CSCF) is first node for UE to be visited. It acts as outbound/inbound SIP proxy server.
- I-CSCF (Interrogating CSCF) has interfaces to databases HSS and SLF (based on Diameter protocol). When I-CSCF receives one request from UE, it routes it to relevant S-CSCF.
- S-CSCF (Serving CSCF) is central node for controlling session. It has functionality of the SIP server and SIP register and it offers the registered services to users.

- A PSTN/CS gateway interfaces with PSTN circuit switched (CS) networks:
  - A Signaling Gateway (SGW) interfaces with the signalling plane of the CS.
  - MGCF (Media Gateway Control Function) is central part of the PSTN/CS (Circuit Switched) gateway. It is used for converting call session protocol (between SIP used in IMS to ISUP/BICC on CS network).
  - MGW (Media Gateway) is interface with PSTN and another CS network (media plane). It is used to transcoding (when the codecs used in IMS and CS network don't match).
- HSS (Home Subscriber Servers) and SLF (Subscriber Location Functions) are user databases. HSS is central database and it is equivalent to HLR (Home Location Register) in the GSM architecture and it stores all data about user. SLF is needed to map user addresses in the case when a few HSS is used in home network.
- Application Servers (AS in figure x) is SIP entity with functions of storing and executing services. There are three AS on Fig 3:
  - SIP AS for storing and executing IP multmedia services based on SIP protocol
  - OSA-SCS (Open Service Access-Service Capability Server) is interface to OSA application servers.
  - IM-SSF (IP Multimedia Service Switching Function) is specialized AS which enable communication with CAMEL AS (Customized Applications for Mobile Network Enhanced Logic).
- MRF (Media Resource Function) enable announcements of the message, combined different media streams and transcoding between different coding shemes. MRF has two components:
  - MRFC (Media Resource Function Controller) is signalling plane node with function equivalent to SIP user agent (SIP UA). It controls MRFP.
  - MRFP (Media Resource Function Processor) is media plane node with function of mix or process media streams.
- BGCF (Breakout Gateway Controller Function) is SIP proxy which processes requests for routing from an S-CSCF when the S-CSCF has determined that the session can't be routed using DNS or ENUM/DNS. It includes routing functionality based on telephone numbers.

M.TEL uses Huawei IMS solution, SW Release 5, but functions of the basic elements of the IMS architecture are the same.

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