ALTERNATIVES OF PROVIDING IPTV USING IMS

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ABSTRACT
In this paper, we specify the realization of IPTV platform based on IMS. We provide an analysis of advantages and disadvantages of possible alternatives of providing IPTV over IMS. On the example, which is contained in the case study are on the hypothetical area shown differences between given alternatives.

General Terms
IP Multimedia Subsystem, IPTV services

Keywords
IMS, IPTV, IMS-based, IMS-integrated, broadcast, multicast, unicast

1. INTRODUCTION
In area of efficiency is an important factor the amount of control messages required to support Access and control of IPTV services (broadcast, Video on Demand, targeted advertising, Time-Shifting). Differences between IMS-based approach and IMS-integrated approach are visible particularly in this area. IMS-based approach requires extra SIP messages to allow access and control of services, as well as management of protocols used for IPTV, where we include for example RTSP, IGMP or HTTP. IMS-integrated IPTV requires three to four times less messages for direct television broadcasting services. [1]

2. CHARACTERISTIC OF IMS-BASED AND IMS-INTEGRATED APPROACH
An increasing number of reports that are associated with IMS-based IPTV approach, is sometimes named as "tax SIP messaging". SIP messaging tax makes increase in the time required to switch between channels. Due to this fact, it becomes ineffective quick change channels, which is between IPTV users very popular. [1]

Alcatel-Lucent Bell Labs analyzed the IMS-based IPTV signalling. The results of this study show:

- IMS-based resource control mechanism generates 50% more signalling messages compared with non-IMS-based approach. By control messages of services on demand it is a three to four increase in the control messages. By linear services (broadcast) this increase is seven to eight times.
- Probability of network congestion with messages by customer Personal Video Recorder (PVR) activities is within IMS-based approach very high. PVR customer sessions will begin simultaneously during most watched period.
    - Messages of control sources can be in IMS-based approach the reason of increased signaling load during most watched period of up to 66%. [1]

From the perspective of the service provider is an important factor the fact, that the provision of IMS-integrated IPTV services, is based on data obtained from the above Alcatel-Lucent Bell Labs analysis, efficiently.

Another important fact is that the SIP messages generate chargeable items for communications services (VoIP, SMS), because users are charged for the service (a call, a SMS). However, in IPTV these extra SIP messages bring not any additional income from charging of services. Users are usually priced packages of broadcast services or purchased CoD services. [1]

IMS-integrated IPTV approach brings these opportunities:

- smooth transition from existing platforms to IMS,
- efficient management of services (without SIP messages tax),
- quick change of channel,
- efficient management of multicast,
- open interface for integration with web services,
- support of mixing services. [1]

3. CASE STUDY OF PROVIDING IPTV WITH USING IMS
We decided to apply IMS platform to a hypothetical field with a predetermined number of households / connections. We consider possible increase in the number of households in the coming years. In terms of cost it is better now reckon with a higher number of connections than in the future to expand the architecture. In our proposed network architecture we reckon with backup line between Super Head End and regional levels, as well as the regional levels and local levels, which will serve to ensure the delivery of content in the event of failure of the primary link.

The integration of IMS and IPTV allows providing of combined telephony and IPTV services. IMS is compatible with fixed (DSL, Ethernet), mobile (GSM, GPRS) and wireless (WLAN, WiMAX) networks. To work with PSTN, it is necessary to use gateway for translation of signaling and voice flow between the IMS network and the PSTN.

3.1 Architecture of the proposed network
Our proposed network architecture consists of three levels. At the highest level is Super Head End (SHE) which consists of Head End and Middleware together with IMS core. Super Head End is the primary source of IPTV program structure. We assume using of regional and local level in order to lower load of SHE with requirements of end users. At the regional level is content processed and delivery to the local level in real time. The regional level may also receive the content from local sources, for example in the case of local broadcast television.

The task of SHE is to perform aggregation of content, making content from different suppliers captured and unencrypted by satellite receivers. By conversion is received content

converted into a distributable via IPTV system. SHE also makes management of rights for access to digital media (Digital Rights Management - DRM). In Head-End are elements that enable receiving signals from satellites, and also provide the encoding of the received signal. Multicast streaming, content encryption, as well as the charging are done by Middleware. Compressed content is also distributed to the regional level. Management of session can be provided by the Middleware or IMS core. In our proposed architecture would be appropriate to use equipment 5060 ICS (IMS Call Server), which performs the function of P-CSCF, I-CSCF, S-CSCF, BGCF, Application Server and MGCF. It is intended also to charging function. This is a product of Alcatel - Lucent.

In our case study, Super Head End provides content delivery to the eight regional levels, considering the optical network based on DWDM, with a speed of 10 Gbps.

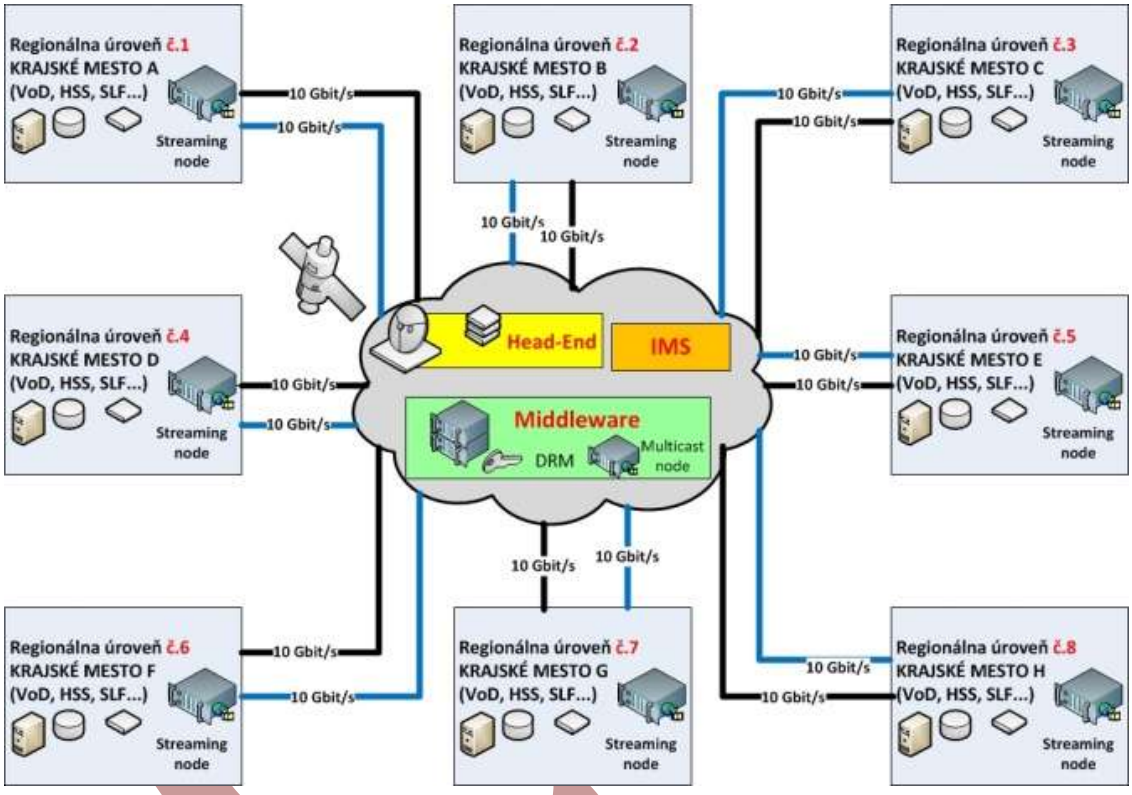

Fig 1: Content delivery to regional levels with backup lines

Location of VoD servers, servers with advertisement, recording servers, backup servers, and servers with databases of users (HSS and SLF) at SHE level, would bring the authentication processes and user requirements of VoD at SHE. SHE would be loaded with requirements from users. If, for example, 100 000 users would want at the same time watch HD movie in 720p from VoD servers that are centrally located (at the SHE level), the central network would be loaded 7 Mbps per 100 000 users, that is up to 700 Gbps.

Placing of these components depends on several factors. Suppose, that in one region are 10 000 users at the same time watching session of the archive (VoD), and as always, at the time of 18:00 to 22:00. Of these, 70% would be interested in watching of this content in HD quality. Therefore assume 7000 times unicast delivering of HD channel in 720p (7 Mbps) and 3000 times unicast delivering of content in SD quality (3,5 Mbps), which would load nearly 60 Gbps. For this reason, we decided to place these components on the local level to reduce load on the regional level. Location of these components at the regional level could be sufficient in the region with countryside, where the charges for using of archive would be too high for local incomes, and therefore VoD services would be less used.

Processors at the regional level may perform compression of content in a format suitable for distribution to the local level. Equipment in the local level in our case study supports multicast. The regional level will then transmit only one stream of data for each channel. If the local level did not support multicast, we would need at the regional level create a unique data stream for each user.

The content is then routed from each regional level to local levels with 10 Gbps fiber lines. Each of local level contains a local hub through which is content delivery to individual households. In the case study we consider with using access technology FTTH GPON.

In our case study, we have in mind the stochastic behaviour of users, where we assume that not all users are interested in watching channels at the same time. We also assume some restrictions, such as the service archive (VoD) will be charged, to eliminate a large number of unicast connections.

In principle, it is necessary to assume, what the average bitrate of a stream is, and how many TV channels at the time one user (1 household) has available. As mentioned above, in the case study we consider the provision of multicast delivering of Live TV in SD or HD quality. Regional level delivery only one stream of data for each channel to the local level. The data provided by users of the VoD servers are delivered unicast to users; therefore it is necessary to create a unique stream of data for each user.

We assume that each household will be able to watch one HD channel at the same time (7 Mbps using the protocol MPEG4 and streaming protocol RTP), one SD channel (3,5 Mbps), and will be also possible to use PVR service to record content in HD (7 Mbps). For telephony services assume using of G.711 codec, which requires 64 Kbps. With these considerations, it is sufficient to provide for each household a connection with speed of 20 Mbps, which covers IPTV and telephony services.

In this case study, we consider the provision of 120 TV channels, 30 of them are in 720p HD. So, to the level of hub is needed to bring the 90 x 3,5 Mbps and 30 x 7 Mbps. It makes 0,525 Gbps for Live TV, which will be provided to individual households through multicast. As we considered the stochastic behavior of the users and the restrictions imposed, we can assume that, for example in region with 1000 households 50% of households will use high-definition archive service (VoD), representing 3,5 Gbps. Based on the facts is for providing of Live TV and VoD necessary to bring to the hub level 4,25 Gbps. Our proposed network capacity is also sufficient to provide the high speed internet (in tens of Mbps), but we are focused on a combination of IPTV services with telephony using IMS.

The proposed architecture for IPTV services is shown in the following figure.

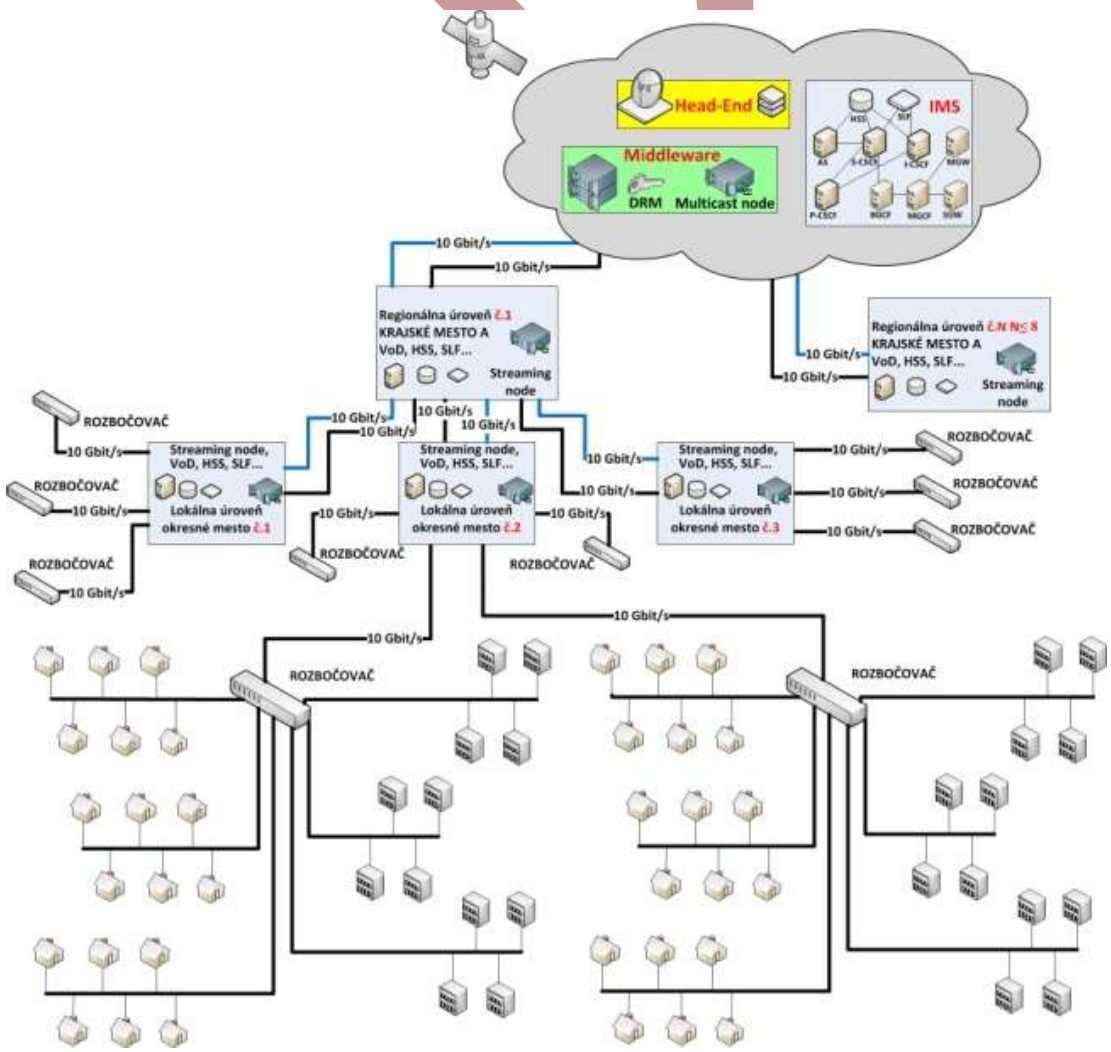

Fig 2: Proposed network architecture

3.2 Analysis of the differences between the IMS-based and IMS-integrated

By integration of IMS and IPTV, there are two possible approaches – IMS-based and IMS-integrated. In our case study, the alternatives can be applied in the following ways.

In the case of IMS-based approach is the receiving of signals from satellites, and its subsequent processing, performed by Head End and Middleware. Management of IPTV session is implemented in IMS core. IMS is compatible with many fixed, mobile and wireless networks. For the purpose of signaling translation between IMS network and PSTN networks assume the use of equipment 7515 Media Gateway (MGW), which is a product of Alcatel-Lucent, and makes translation of signaling and voice flows.

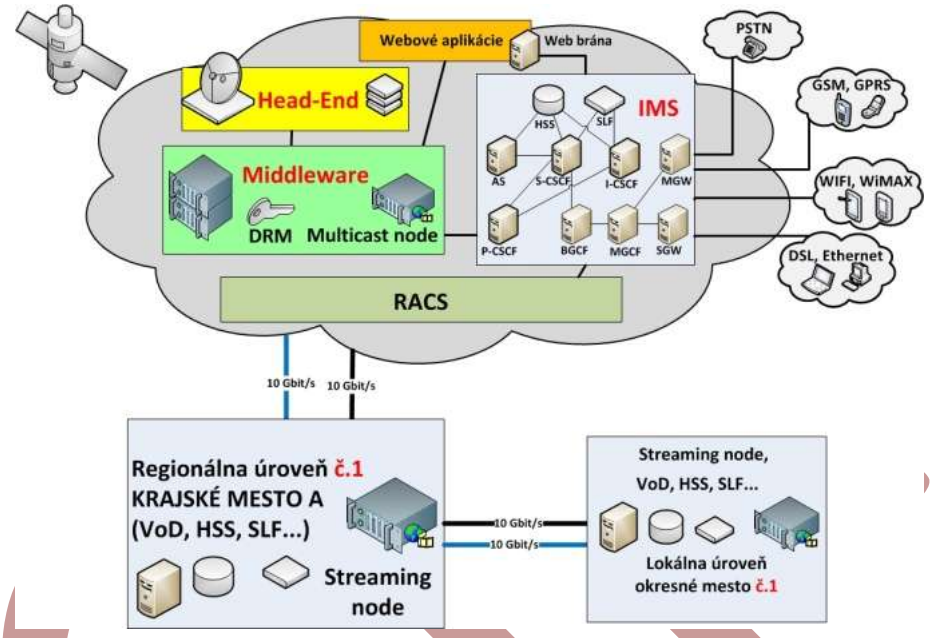

Fig 3: IMS-based approach

In the case of IMS-integrated approach is the IPTV "nearby" IMS. Processing of content received by Head End is performed in Middleware. IMS core is used for the processing of telephony signaling translation and voice flow between IMS and PSTN network, which uses equipment MGW.

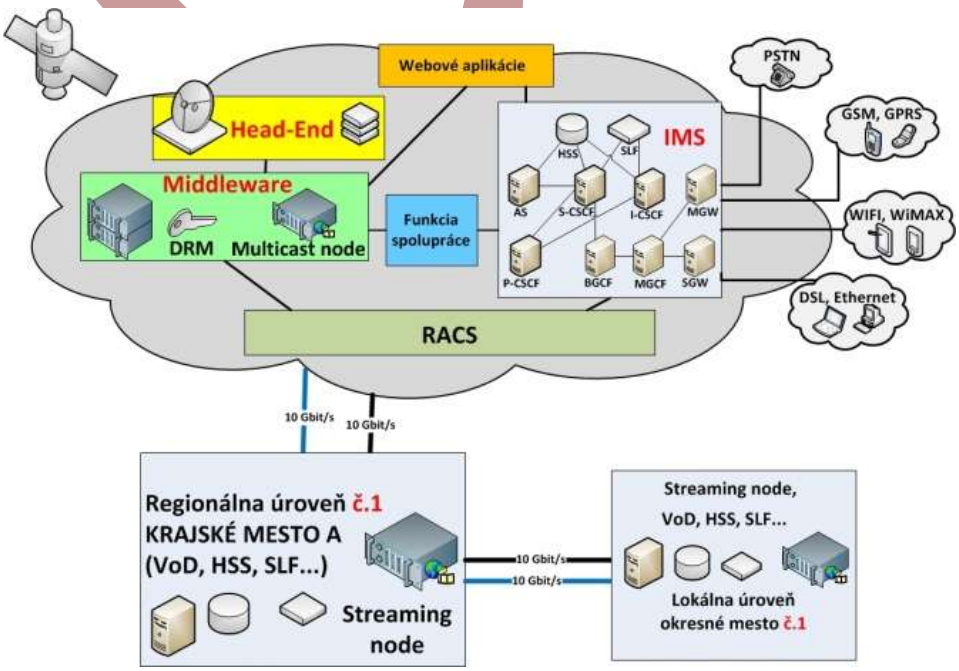

Fig 4: IMS-integrated approach

Based on the above facts, we are in the evaluation of various alternatives to provide IMS IPTV conclude that our evaluation is significantly influenced by the fact what kind of service provider is.

When we talk about the provider, which already provides IPTV, we assume, this provider has all the features enabling IPTV services. In this case, it is the transition to the provision of IPTV over IMS sufficient implementation only those elements of the IMS architecture with such capabilities to allow end users to manage and provide telephony services combined with IPTV services. IMS-integrated solution looks like suitable, and also due to a lower number of SIP messages sent by the network.

In the case of a provider who has IMS architecture, and decided to expand its services on IPTV, looks better the solution IMS-based. This provider has all the necessary elements of IMS architecture for managing telephony services and IPTV services. It is not therefore necessary to implement complete IPTV architecture. It is important to use the combination of only those elements that are necessary for the completion of functionalities, which IMS itself does not. These are the elements for receiving content from satellites and processing of the content so, that it's possible transfer it to end-users and correct decode it in user devices – set-top boxes. Despite the greater number of SIP messages, which in this case are sent across the network, the solution is advantageous, because it does not require an investment in a complete IPTV infrastructure.

4. CONCLUSION

At this time alternative IMS-based IPTV is not a very preferred by the world's leading telecommunications operators. In the competitive struggle on the market IMS-based IPTV approach is not the big advantage. Added value for IMS IPTV can also be used in IMS-integrated solutions. Development of IPTV is therefore moving more towards alternatives IMS-integrated approach and solutions Multiscreen Video Platform.

ACKNOWLEDGMENTS

5. ACKNOWLEDGMENT

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