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IPTV in VANET's with WiMAX Access Network

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ABSTRACT: The IPTV in VANET's with WiMAX access network is presented in this paper. The vehicular IPTV service can be provided using WiMAX access network. The internet protocol television services as an entertainment application over VANET's is play very important role in the future of intelligent transportation systems and vehicular infotainment systems. IPTV service over VANETs is an attractive system to many IPTV service providers by transmitting television programs through IP-based wireless networks during car journey.The Mobile WiMAX End-to-End Network Architecture is based on an All-IP platform and it has all packet technology with no any legacy circuit telephony. This is explained in this paper. The IP-based WiMAX architecture has ASN and CSN is also described in this paper.

KEYWORDS*:* IPTV, VANET, WiMAX, ASN, CSN

I. INTRODUCTION

In wireless communication, the VANETs try to increase transportation safety, efficiency and security. In this article the focus on VANET infotainments system and its aim to increase user satisfaction during car journeys. IPTV service over VANETs is an attractive system to many IPTV service providers by transmitting television programs through IP-based wireless networks. VANET-based IPTV services are considered to play a very important role in the future of vehicular infotainment and intelligent transportation systems. Vehicular IPTV aims to make the traditional IPTV and related services available to users anywhere, anytime also during the car journey. The vehicular IPTV services can be provided using different types of access networks. The vehicular IPTV user may connect with mobile using different access network like WiMAX, IEEE 802.11 and LTE networks or other wireless networks. In this paper we discuss about only WiMAX access network [1] [11][12].

One of the main goals of the Intelligent Transportation Systems is to improve safety on the roads, and reduce traffic congestion, waiting times, and fuel consumptions. The integration of the embedded computers, sensing devices, navigation systems (GPS), digital maps, and the wireless communication devices along with intelligent algorithms will help to develop numerous types of applications for the ITS to improve safety on the roads.

In this paper, we use WiMAX access network with IPTV in vehicular ad-hoc network. WiMAX is world-wide interoperability microwave access and wireless broadband technology. It has IEEE 802.16 wireless standard family and 30 to 40 megabit per second data rate. The type of WiMAX are fixed WiMAX and mobile WiMAX. This is very useful technology for IPTV in VANET system which is explained in section. The application of WiMAX are internet access, group communications, metropolitan area distributed service, content based distribution, multihoming applications and quality guaranteed applications[6] [7] [8].

In this paper the Section I describes about overview of IPTV in VANET system. Section II tells detailing about IPTV and vehicular network. Section III describes Basic requirements and IP-Based architecture of WiMAX,. Section IV shows System Design of IPTV in VANET using WiMAX access network. Finally we show conclusion of this paper in section V.

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II. LITERATURE REVIEW

IPTV based VANET system describes VANET infotainments that aim to increase user satisfaction during car journeys. IPTV service over VANETs is an attractive feature to many IPTV service providers by transmitting television programs through IP based wireless networks. VANET-based IPTV services are considered to play a very important role in the future of vehicular infotainment and intelligent transportation systems. Vehicular IPTV aims to make the traditional IPTV and related services available to users anywhere, anytime also during the car journey [1]. IPTV is one of the most highly visible services to emerge as part of the development of next generation network (NGN). In this paper papper IPTV architecture developed by ITU-T and provide functional architecture for NGN-based IPTV services according to functional mapping between IPTV and NGN [9].The concept of vehicular ad-hoc networks enables the design of emergent automotive safety applications, which are based on the awareness among vehicles. Recently, a suite of 802.11p/WAVE protocols aimed at supporting car-to-car communications was approved by IEEE. Existing cellular infrastructure and, above all 3GPP LTE, is being considered as another communication technology appropriate for vehicular applications [10]. We reviewed some of the most prominent architectures that have been recently proposed to support IPTV and we analyzed some of the benefits associated with these design architectures. With users being increasingly mobile and the strong proliferation of handheld devices with Internet access anywhere, anytime, emerging mobile IPTV systems are also gaining a lot of attention, and user trends demonstrate that such systems will continue to be in demand. [12].

III. IPTV AND VEHICULAR NETWORK

A.VANET

Recent advances in wireless networks have led to the introduction of a new type of networks called Vehicular Networks. Vehicular Ad Hoc Network (VANET) is a form of Mobile Ad Ho Networks (MANET). VANETs provide us with the infrastructure for developing new systems to enhance drivers' and passengers' safety and comfort. VANETs are distributed self organizing networks formed between moving vehicles equipped with wireless communication devices. This type of networks is developed as part of the Intelligent Transportation Systems (ITS) to bring significant improvement to the transportation systems performance[3] [4] [10].

Vehicular networks are composed of mobile nodes, vehicles equipped with On Board Units(OBU), and stationary nodes called Road Side Units (RSU) attached to infrastructure that will be deployed along the roads. Both OBU and RSU devices have wireless/wired communications capabilities. OBUs communicate with each other and with the RSUs in ad hoc manner. There are mainly two types of communications scenarios in vehicular networks such as Vehicle-to-Vehicle (V2V) and Vehicle-to-RSU (V2R). The RSUs can also communicate with each other and with other networks like through the internet. Vehicular Networks are expected to employ variety of advanced wireless technologies such as Dedicated Short Range Communications (DSRC), which is an enhanced version of the WiFi technology suitable for VANET environments. The DSRC is developed to support the data transfer in rapidly changing communication environments, like VANET, where time critical responses and high data rates are required.

B. IPTV

Internet Protocol Television (IPTV) is a system where a digital television service is delivered over internet protocol network.IPTV works on the TV with a set-top box that accesses channels, subscription services on demand and other interactive multimedia services over a secure, end-to-end operator managed broadband IP data network with desired QoS to the public with a broadband internet connection [13].

IPTV system may also include internet services such as web access and VOIP so it may be called Tripe play and is typically supplied by broadband operator using the same infrastructure. IPTV is not internet video but it simply allows users to watch videos, like movie previews and web-cams, over the internet in best effort fashion. IPTV technology offers revenue-generating opportunities for the telecom and cable service providers. For traditional Telephone service providers, Triple play is delivered using a combination of optical fibre and digital subscriber line (DSL) technologies to its residential base. Cable television use a similar architecture that is called hybrid fibre coaxial (HFC) to provide

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subscriber homes with broadband, but use the available coaxial cable rather than twisted pair for last mile transmission standard. Subscriber homes can be in a residential environment, multidwelling units, or even in a business offices.

IV. WiMAX ARCHITECTURE AND ITS REQUIRMENTS

A, WiMAX Access Network

WiMAX is a standards-based technology enabling the delivery of last mile wireless broadband access as an alternative to wired broadband like cable and DSL. WiMAX provides fixed , nomadic, portable and, soon, mobile wireless broadband connectivity without the need for direct line of-sight with a base station IV. In a typical cell radius deployment of three to ten kilometers, WiMAX Forum Certified™ systems can be expected to deliver capacity of up to 40 Mbps per channel, for fixed and portable access applications.

1)Basic Requirements of WiMAX Architecture:

The Mobile WiMAX End-to-End Network Architecture is based on an All-IP platform, all packet technology with no any legacy circuit telephony. It offers the advantage of reduced total cost of ownership during the lifecycle of a WiMAX network deployment. The use of All-IP means that a common network core can be used, without the need to maintain both packet and circuit core networks, with all the overhead that goes with it. Following are the basic requirements that have guided the WiMAX architecture development.

1. The architecture is based on a packet-switched framework, including native procedures based on the IEEE 802.16 standard and Ethernet standards.
2. The architecture permits decoupling of access architecture and supported topologies from connectivity IP service. Network elements of the connectivity system are agnostic to the IEEE 802.16 radio specifics.
3. The architecture allows modularity and flexibility to accommodate a broad range of deployment options such as:
   - Small-scale to large-scale WiMAX networks.
   - Urban, suburban, and rural radio propagation environments
   - Licensed or licensed-exempt frequency bands
   - Hierarchical, flat, or mesh topologies, and their variants
   - Co-existence of fixed, nomadic, portable and mobile usage models
4. The end-to-end architecture includes the below support for services and applications:
   - Voice, multimedia services and other mandated regulatory services such as emergency services
   - Access to a variety of independent Application Service Provider (ASP) networks in an agnostic manner
   - Mobile telephony communications using VoIP
   - Supporinterfacing with various interworking and media gateways permitting delivery of services translated over IP, e.g. SMS over IP, MMS, WAP, to WiMAX access networks
   - Support delivery of IP Broadcast and Multicast services over WiMAX access networks
5. Interworking and Roaming is another key strength of the End-to-End Network Architecture with support for a number of deployment scenarios.

B. WiMAX Network IP-Based architecture

1. The below Diagram is of WiMAX network IP-based architecture which gives a direct and clear description of WiMAX network architecture. This architecture is roughly divided into three parts: user terminals, ASN, and CSN. The user terminals are further classified into three types: fixed, portable, and mobile. The ASN and the CSN includes some main network devices.

1)ASN

The ASN(Access Service Network) is defined as a complete set of network functions needed and it provide radio access to a WiMAX subscriber.It consist mobile WiMAX base station and access service gateway network. The ASN mainly provides the following functions:

- WiMAX Layer-2 (L2) connectivity with WiMAX mobile station
- Transfer of Authentication, Authorization and Accounting (AAA) messages to WiMAX subscriber's Home Network Service Provider (H-NSP) for authentication, authorization and session accounting for subscriber sessions

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- 3.Network discovery and selection of the WiMAX subscriber's preferred NSP
- Relay functionality for establishing Layer-3 (L3) connectivity with a WiMAX MS (i.e. IP address allocation)
- Radio resource management
- Mobility management within ASN, for instance, handover, paging and location management
- ASN-CSN tunneling.The ASN can be devided into one or more BSs and one or more ASN gateways. The main function of the BS is to provide air interfaces for the MS, while the ASN gateway acts as a L2 service convergence point within the ASN. One ASN can be shared by several CSNs. That is to say, it can provide wireless access services for CSNs of different NSPs at the same time.

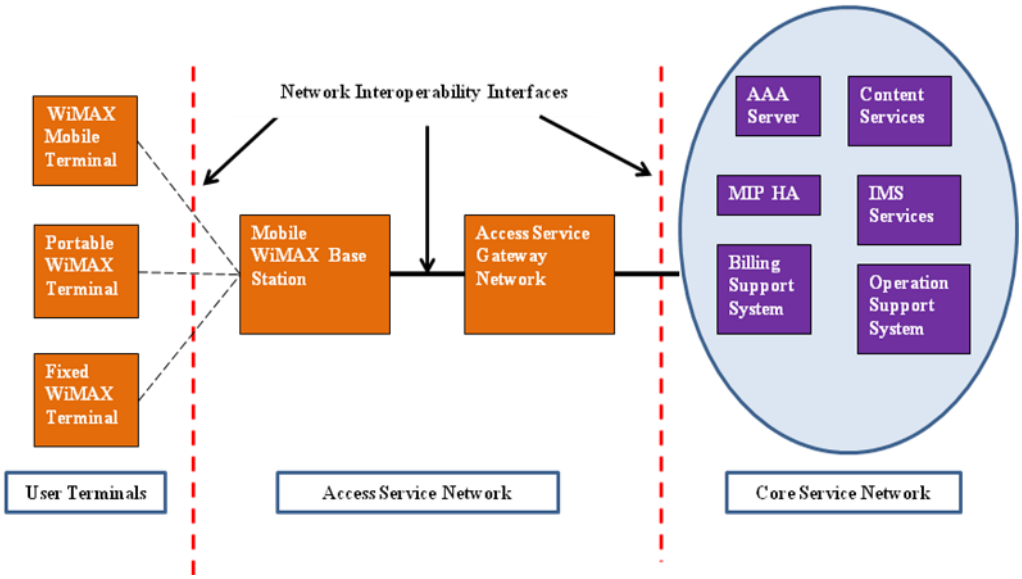

Fig 1 WiMAX Network IP-Based Architecture.

2) CSN

The CSN(Core Service Network) is defined as a set of network functions and it povide IP connectivity services to the WiMAX subscriber(s). A CSN mainly provides the following functions:

- MS IP address and endpoint parameter allocation
- Internet access
- AAA proxy or server;
- Admission Control based on user subscription profiles
- .ASN-CSN tunneling support
- WiMAX subscriber billing and inter-operator settlement
- Inter-CSN tunneling for roaming;
- Inter-ASN mobility management;
- WiMAX services, such as location based services, peer-to-peer services, broadcast and multicast services, IP multimedia services and emergency call services.

To realize the above functions, a CSN may comprise network elements such as routers, AAA proxy/servers, user databases, and Interworking gateway devices.

V. SYSTEM DESIGN

A. IPTV in VANET's with WiMAX Access Network

The below diagram is of Main Components of a VANET-based IPTV system with WiMAX access Network and It consist five main parts such as IPTV headend, core network, metro backbone, access network and Customer Network.The IPTV head end has a video-on-demand (VoD) server and video source are delivering video and content

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and this content is the original TV channels.The TV channelsare send to the core network which represents a high-speed communication infrastructure.

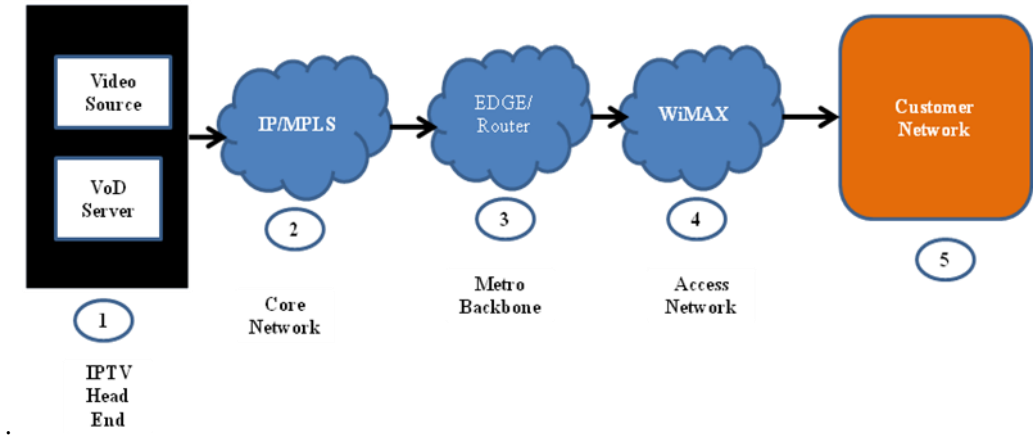

Fig.2.Components of a VANET-based IPTV system with WiMAX access Network

The core network send the video streams from the head end to the metro backbone and core network consist IP or MPLS protocols. The metro backbone is interconnection between the core network and with the different access networks. But in above diagram we connect it only with WiMAX access network. The metro backbone has main function to multiplex the different service providers and to adapt the transport system to the specific characteristics of the subscriber loop. Therefore, the metro backbone must perform data transmission and switching tasks efficiently. It consist also EDGE and Router. The elements that transport the multimedia content to the customer network (subscribers) from the access network which may be DSL-based containing broadband remote access server and DSL access multiplexers.

Here we use access network which could be WiMAX and the WiMAX contain the components like ASN-GW (access service network - gateway) connecting the edge router to a base station (BS) which may transmit the TV channels to the mobile users either using unicast which is CID i.e connection identifier or multicast which is MCID i.e multicast connection identifier.

In case of a VANET-based IPTV system with WiMAX access network ,the mobile stations MS would represent the devices in the cars which there will present the TV programs to the users. If WLANs or LTE would be used to deliver IPTV services in a VANET, the situation would be very similar to what is illustrated for WiMAX in figure.
The WiMAX access network manages the user demands by using the return channel. The main requirement of an WiMAX access network is to have enough bandwidth to support multiple IPTV channels as demanded by the currently active set of subscribers.

Finally, the customer, e.g., sitting in the cars if we assume access via a V2I communication system, may be connected to the access network either directly or have their own local network which enables indirect communication and information exchange between the user's device (e.g. TV set) and the WiMAX access network. This direct or indirect communication allows accessing the available resources in the IPTV network in vehicular system.

VI. CONCLUSION

We conclude that WiMAX access network is good for VANET infotainment system that aims to increase user satisfaction during car journeys. IPTV service over VANETs is an attractive system to many IPTV service providers by transmitting television programs through IP based wireless networks. In this paper we discuss also about WiMAX access network in VANET based IPTV system and WiMAX architecture.

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