IPTV over WiMAX

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Outline

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Introduction of IPTV (1)

• Internet Protocol television (IPTV) provides digital television services over Internet Protocol (IP) for residential and business users at a lower cost.

• IPTV services includes
  – Commercial-grade multicasting TV
  – Video on demand (VoD)
  – Triple play
  – Voice over IP (VoIP)
  – Web/email access
Introduction of IPTV (2)

- The IPTV service first started in Japan in 2002, then became available in Korea.
- The current quality of IPTV in the United States does not yet approach that of cable TV services, but the gap will shrink as bandwidth increases and video codec improve.
- In 2005, there were about four million homes in the world that already had IPTV.
- Asia has been at the forefront of IPTV services, launching IPTV service tests in eight out of thirteen economies in the Asia-Pacific region.
Introduction of IPTV (3)

• Microsoft TV IPTV Edition is a software platform to develop TV services over broadband networks.
• BellSouth, a telecommunication service provider, recently performed trials of Microsoft IPTV.
• AT&T and Verizon recently announced significant investments in adopting fiber optic cables to deliver IPTV channels to residential customers.
IPTV Services

IPTV content Delivery services (sources, database, programs)

CORE networks (IP/GMPLS/MPLS and multicast)

FTTx

xDSL

Carrier ethernet

802.11n WLAN

IPTV devices

IPTV devices

IPTV devices

IPTV devices

IPTV devices
IPTV Features

- **Selection**: users are able to select their TV programs with fast channel selection and short channel changing time.
- **Storage**: TV programs are stored in local storage devices so that users can watch them anytime; furthermore, service providers should store at least 100 hours of TV programs and videos.
- **QoS**: QoS must be guaranteed; a standard definition TV and a high definition TV need bandwidth of 1~4 Mb/s and 4~12 Mb/s, respectively.
- **Low cost**: cost to the user must be low; this is the key to success
QoS Metrics

• For video:
  – Jitter
  – Number of out-of-sequence packets
  – Packet-loss probability
  – Network fault probability multicast join time
  – delay

• For voice:
  – Mean opinion score (MOS)
  – Jitter
  – Delay
  – Voice packet loss rate

• For IPTV services:
  – Channel availability
  – Channel start time
  – Channel change time
  – Channel change failure rate
DSL Technologies (1)

![Diagram of DSL Technologies]
DSL Technologies (2)

• Downlink speed of a typical DSL is about 128 kb/s ~ 24 Mb/s, depending on the service providers.
• ADSL standards can deliver 8 Mb/s over about 2 km, and ADSL2+ can deliver up to 24 Mb/s, depending on the distance between a user and the nearby end office.
• VDSL (very high bit-rate DSL) has a theoretical limit of 52 Mb/s downstream and 12 Mb/s upstream.
• VDSL2 (very-high-bit-rate digital subscriber line 2, ITU-T G.993.2 Standard) provides full-duplex aggregate data rates up to 200 Mb/s using a bandwidth up to 30 MHz.
Carrier-grade Ethernet

- Carrier-grade Ethernet can provide up to 10 Gb/s access speed, eight classes of service (CS) and unicast/multicast/broadcast modes via a virtual local area network (VLAN) technique.
High Throughput IEEE 802.11n Wireless LAN

• The IEEE 802.11 Task Group (TGn) was announced in January 2004 to improve throughput of the IEEE 802.11 WLAN to 100 Mb/s ~ 600 Mb/s, as well as offering a better operating range than current networks.

• There are two competing PHY proposals for the IEEE 802.11n standard:
  – World-Wide Spectrum Efficiency (WWiSE) supported by Broadcom, Texas Instruments, and others
  – TGn Sync supported by Intel, Philips, and others
FTTx

- FTTH and fiber to the premises (FTTP) use fiber-optic cables for IPTV services to businesses and homes.
- They will be ideal choices for access networks as fiber deployment cost decreases.
Core Networks

• These connect the access networks to customer premises and can be simply a single national distribution network running Gigabit Ethernet or IP/MPLS plus various regional distribution networks running carrier-grade Ethernet.
WiMAX’s Evolution

- **IEEE 802.16-2001**
  - Frequency range: 10~66 GHz
  - Theoretical maximum bandwidth: 120 Mb/s
  - Theoretical maximum transmission range: 50 km
  - Only supports line-of-sight (LOS)

- **IEEE 802.16a-2003**
  - Supports non-LOS (NLOS) transmission
  - Adopts OFDM at the PHY layer
  - Supports for the 2-11 GHz

- **IEEE 802/16d-2004**
  - Technical specifications for the PHY and MAC layers for fixed wireless access
Mobile WiMAX (IEEE 802.16e)

- Advanced antenna diversity schemes
- Hybrid automatic repeat request
- Dense subchannelization
- Adaptive antenna system (AAS)
- Multiple input multiple output (MIMO) technologies
- A downlink subchannelization scheme
Salient Features of WiMAX

- OFDM-based physical layer
- Very high peak data rates
- Scalable bandwidth and data rate
- Adaptive modulation and coding (AMC)
- Link-layer retransmissions
- Support for TDD and FDD
- Orthogonal frequency division multiple access (OFDMA)
- Flexible and dynamic per user resource allocation
- Support for advanced antenna techniques
- Quality-of-service
- Robust security
- Support for mobility
- IP-based architecture
Wireless Services

- Multimedia streaming
- Real-time surveillance
- Voice over IP (VoIP) replacing cellular technology
- Multimedia conferencing
- Backbone network
# Quality of Service

<table>
<thead>
<tr>
<th>QoS category</th>
<th>Applications</th>
<th>QoS specifications</th>
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<tbody>
<tr>
<td>UGS Unsolicaited grant service</td>
<td>VoIP</td>
<td>Max. substaned rate</td>
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<tr>
<td></td>
<td></td>
<td>Max. latency tolerance</td>
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<tr>
<td></td>
<td></td>
<td>Jitter tolerance</td>
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<tr>
<td>rtPS Real-time polling service</td>
<td>Streaming audio or video</td>
<td>Min. reserved rate</td>
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<tr>
<td></td>
<td></td>
<td>Max. substaned rate</td>
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<td></td>
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<td>Max. latency tolerance</td>
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<td>Traffic priority</td>
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<tr>
<td>ErtPS Extended real-time polling</td>
<td>Voice with activity detection (VoIP)</td>
<td>Min. reserved rate</td>
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<tr>
<td>service</td>
<td></td>
<td>Max. substaned rate</td>
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<td>Jitter tolerance</td>
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<td>Traffic priority</td>
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<tr>
<td>nrtPS Non-real-time polling</td>
<td>File Transfer Protocol</td>
<td>Min. reserved rate</td>
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<tr>
<td>service</td>
<td></td>
<td>Max. substaned rate</td>
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<td></td>
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<td>Traffic priority</td>
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<tr>
<td>BE Best effort service</td>
<td>Data transfer, Web browsing, etc.</td>
<td>Max. substaned rate</td>
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<tr>
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<td>Traffic priority</td>
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Potential WiMAX Application

• High-speed mobile data and telecommunications services
• Wireless alternative to cable and digital subscriber line (DSL)
• Connect WiFi hotspots with each other and to the Internet
Why IPTV over WiMAX?

• Maximize the number of subscribers
• Converged wireless broadband access network
• Supporting the future trends
Maximize the Number of Subscribers

- Getting the maximum number of subscribers as soon as possible for a newly launched IPTV service program is a clear goal for any service provider.
- It has been reported from time to time that xDSL and cable broadband access is not available in some areas due to geographical distance and user-density.
- WiMAX offers the ease of deployment similar to other wireless technologies, but with larger service coverage and more bandwidth.
Converged Wireless Broadband Access Network

- WiMAX is considered a very good candidate to provide new services such as wireless broadband access and mobile voice over Internet Protocol (VoIP) telephony.
- Launching IPTV over WiMAX can further achieve economy of scale in terms of more services and better service availability under a common infrastructure.
Supporting the Future Trends

• Enabling rtPS in the wireless broadband access can support perfectly the bandwidth requirements of managed content of the IPTV service providers, especially for paid HDTV and SDTV.

• With a great deal of rich and free on-demand video content, it is a very attractive approach to allow not only home IPTV users, but also mobile users to access this unmanaged content.

• The incorporation of rtPS and BE services can be manipulated to support these demands.
References


