Demonstration Of TVoIP Services In A Multimedia Broadband Enabled Access Network

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Agenda

> Setup Overview

> Involved prototype equipment
  • TVoIP Headend
  • Access Multiplexer with integrated Service Plane
  • Residential Gateway

> Services and use cases
  • Overview
  • HD multicast
  • simultaneous handling of multiple transport stream sources
  • MPEG-2 real time transrating
  • enhanced Pro-MPEG FEC
  • TCP and RTP/RTCP monitoring

> Test results

> Conclusions
General Setup overview

- Demonstrator act as a proof of concept for the MUSE II attention to the multimedia broadband applications
- Setup combines general public & home network elements with new & improved prototype equipment
TVoIP Headend:

- Composed of a video server and a TVoIP gateway prototype
- Support of real-time transcoding,
- Extended support for multiple different source signals (MPEG-2, -4, SD, HD) from multiple physical networks (ASI, ATM, GigE)
- Improved FEC support compliant to Pro-MPEG Forum

One platform providing all relevant video transmission and processing methods and a smooth migration to full packet-based video transmission
Access Multiplexer with Service Plane:

- Service Plane middleware introduce a new plane on top of the existing data and control plane
- Offers an API between commercial Access Multiplexer and new services
- Requires additional hardware resources (SEPIA board)
- Services for demonstrator setup:
  - TCP monitoring (transparently)
  - RTP / RTCP monitoring
- Equipped with VDSL2 board for bitrate consuming video and TV content delivery

The Service Plane is a software platform which allows easy & fast deployment & upgrade of service logic inside an Access Multiplexer.
Residential Gateway:
- Improved hard- and software basis
- Additional interfaces and functionalities
  - Residential SIP server functionality
  - VDSL2 WAN interface
  - Support of TR-069 evolutions
  - WLAN evolutions
- IP acceleration for routed mode

The RGW is composed of a new, more powerful hardware and software with additional interfaces and functionalities – compared to previous version.
Setup overview for different TV and video use cases as well as for monitoring. The platform can handle all relevant transport stream processing and transmission methods.
Services and use cases
HD multicast

Setup overview for different TV and video use cases as well as for monitoring. The platform can handle all relevant transport stream processing and transmission methods.

HD multicast:
- Offers the possibility of multiple HD streams for one user at the same time (watch & record)
- Streams are encoded in H.264 format @ 10 Mbps
- Access Multiplexer with support of VDSL2
- RGW with software IP acceleration framework
Services and use cases
Multiple transport stream sources:

- A stored content source (video server) is connected to the gateway
- A Live TV stream from an external source is connected to the gateway
- Shows opportunity to forward live events coming from broadcast stations as well as insert local TV channels
- Content can be delivered over multiple physical networks (ASI, ATM and GigE)
- Used to generate dedicated TV channel bundles for the customers
Services and use cases
Transrating

- MPEG-2 real time transrating is a remultiplexing feature
- Service provider are able to receive TV channels at high rates and send it to the customers at adapted rates
- Can be used to solve packet loss due to congestions
- Works for all kinds of sources – stored content as well as external delivered live content with and without FEC
- Bandwidth decreasing by 30% was successful tested on MPEG2
Services and use cases
Forward Error Correction

Forward Error Correction:

- Increased quality through improved recovering
- An impaired multicast stream is generated over the network and displayed once over STB with FEC processing and once over a STB without
- Compare corrupted and recovered stream in terms of quality
- solve packet loss due to DSL line / home network loss
- FEC data is carried on different RTP ports than video
Services and use cases
TCP & RTP / RTCP monitoring

TCP & RTP / RTCP monitoring:

- Two protocols are transparently monitored: TCP service (unicast video from VoD server) and RTP multicast service
- TCP monitoring uses the ANTMA algorithm which looks at the TCP data and acknowledgment packets to provide estimations for packet loss
- TVoIP Headend is used to generate RTCP sender reports associated to the RTP stream and the video soft client generates the RTCP receiver reports
- Sender & receiver reports are used to collect network information like packet loss and delay within aggregation network and home network
- Correlation between reported packet loss, injected impairments and disturbed displayed video is given
Test results

general remarks

> the described demonstrator allows for many test options that will only be partly evaluated in the framework of IST MUSE

> explained test cases make no claim to be complete.

> all explained use cases tested successful from a functional point of view

> includes the general ability of multicast transmission and the correct treatment of IGMP signaling

> all mechanisms work properly in switched and routed home network environments (tested with and without NAT)
Test results
generic network parameters

- to validate possibilities of multicast transport throughput, latency and latency distribution were analyzed
- Measurement tool was connected to the edge router instead of the TVoIP Headend and to the RGW instead of the STB
- Results illustrate large potential of VDSL2 in context of providing bit rate consuming HD content

<table>
<thead>
<tr>
<th></th>
<th>ADSL2+</th>
<th>VDSL2</th>
</tr>
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<tbody>
<tr>
<td>Throughput (Mbps)</td>
<td>11.6</td>
<td>50</td>
</tr>
<tr>
<td>Ave. Latency (ms)</td>
<td>4.1</td>
<td>2</td>
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</tbody>
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![Graph of Throughput and Latency](image-url)
Test results
join-and-leave latency

> Important parameter for QoE in context of IPTV delivering is zapping time
> Two different aspects: average overall zapping time as well as join-leave-latency
> The average overall zapping time was measured between 2 and 3 seconds
> Packet loss (without FEC) within the network lead to higher zapping time and considerable fluctuations
> The average join latency was measured with 48.43ms (ADSL2+) and 10.22ms (VDSL2) respectively
Test results
Forward Error Correction

> Further aspect to increase QoE in disturbed network environments is Forward Error Correction
> Two different kinds of packet loss were used: bursty packet loss (5s no loss followed by 1s loss) & random packet loss
> FEC algorithm is able to correct up to 5% random packet loss
> Current configuration of FEC algorithm allows a recovering capacity of 10 consecutive packets loss each 100 packets.
> The burst of 285 packets loss each 1425 packets can not complete recovered by the algorithm.
> Figures below shows a TV screen shots with 1% and 3% random packet loss and no FEC

1% random packet loss
3% random packet loss
Conclusion

> Setup and prototype equipment show the feasibility of delivering multimedia broadband services to the customer

> Evolution of a TVoIP Headend towards a platform for all relevant transport stream processing and transmission methods

> Smooth migration towards a full packet based environment for all TV & video services

> Demonstrated features:
  - TCP & RTP / RTCP monitoring
  - Forward Error Correction and
  - Transrating

> It gives service provider the possibility to react on events within the network which have a negative impact on customer quality of experience just in time.

> Leads to a better service availability, decreasing of operational costs and last but not least to more satisfied customers.
Thank you for your attention

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