Alcatel·Lucent

Technologie-Zentrum Informatik

Universität Bremen

Mitnehm.TV

Personalized Robust Mobile TV in Converging Networks

VDE/ITG-Fachgruppe 5.2.4

Workshop: Mobile TV – Quo Vadis?

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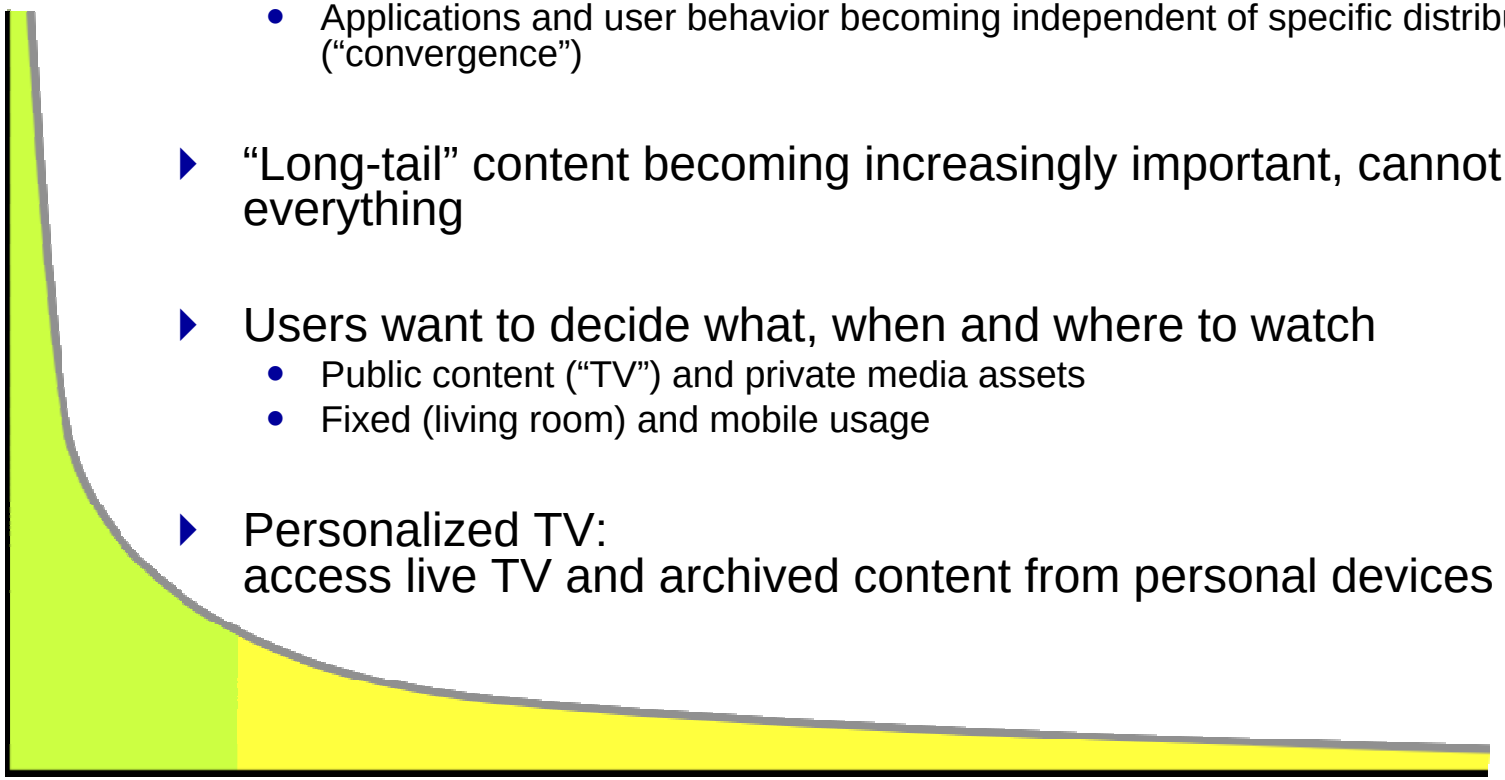
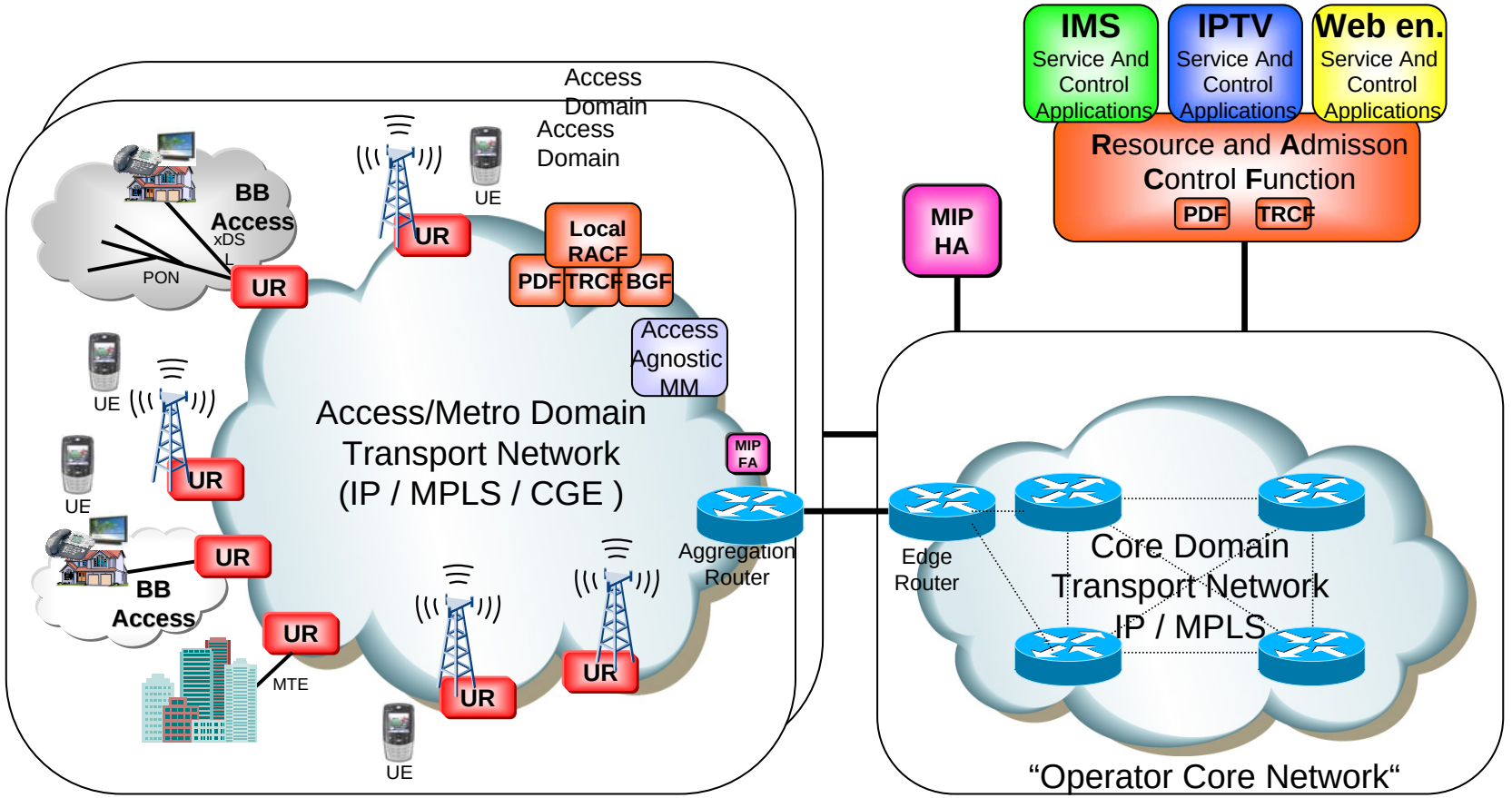
Trends in Mobile Multimedia

- Multiple distribution networks, multiple applications
  - Applications and user behavior becoming independent of specific distribution approach ("convergence")
- "Long-tail" content becoming increasingly important, cannot broadcast everything
- Users want to decide what, when and where to watch
  - Public content ("TV") and private media assets
  - Fixed (living room) and mobile usage
- Personalized TV:
  access live TV and archived content from personal devices



ScaleNet – An Architecture for a Next Generation Wireless/Wireline Convergent Access Network



ScaleNet

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ScaleNet – Demonstrating the Value Proposition of Wireless/Wireline Convergent Access

Quadruple Play = Voice, Data, Video plus Mobility

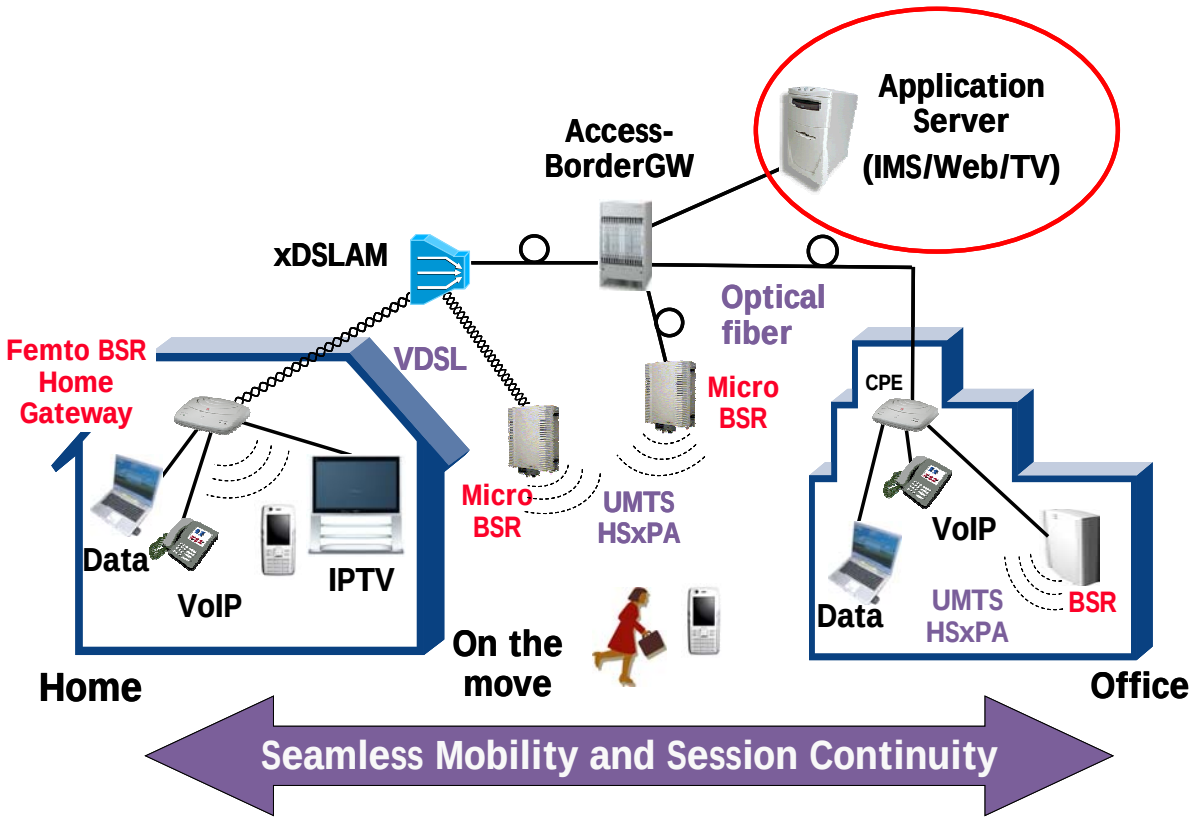
Main research direction, technology view:

- Push the frontiers between access technologies out to the user / edge
- Unified Router (UR) technology supports different access technologies (WIMAX, UMTS, xDSL, …) in one IP-based node
- Flat IP-driven network architecture with joint (wireless/wireline, convergent) control
- Open for rapid introduction of new access technologies
- Seamless integration into ITU-T NGN standardization framework both with IMS and non-IMS service control

Need for demonstrating the value for the user and the service provider:

- Quadruple play applications and services
  - Ubiquitous service around ScaleNet use cases: scenarios at home, and on the move
  - Aiming at a personalized combination of IP-TV, telecommunications and Mobile-TV as an attractive quadruple multimedia showcase
- Fixed-mobile service convergence
  - Session continuity regardless of access technology or end user device
- Easy fixed-mobile network convergence through flat networks
- Basic functionalities of a flat all-IP broadband architecture utilizing Base Station Router (BSR) and a flat IP infrastructure

ScaleNet Scenario for Truly Converged Quadruple Play Services: IPTV and Mobile-TV



- ALU Use Case: "Session Mobility for a Convergent IPTV Service"
- IPTV service over unified wireless or wireline IP network with convergent control (resource and mobility management)
- Seamless session continuity and handover
- Robust transmission for personalized mobile service

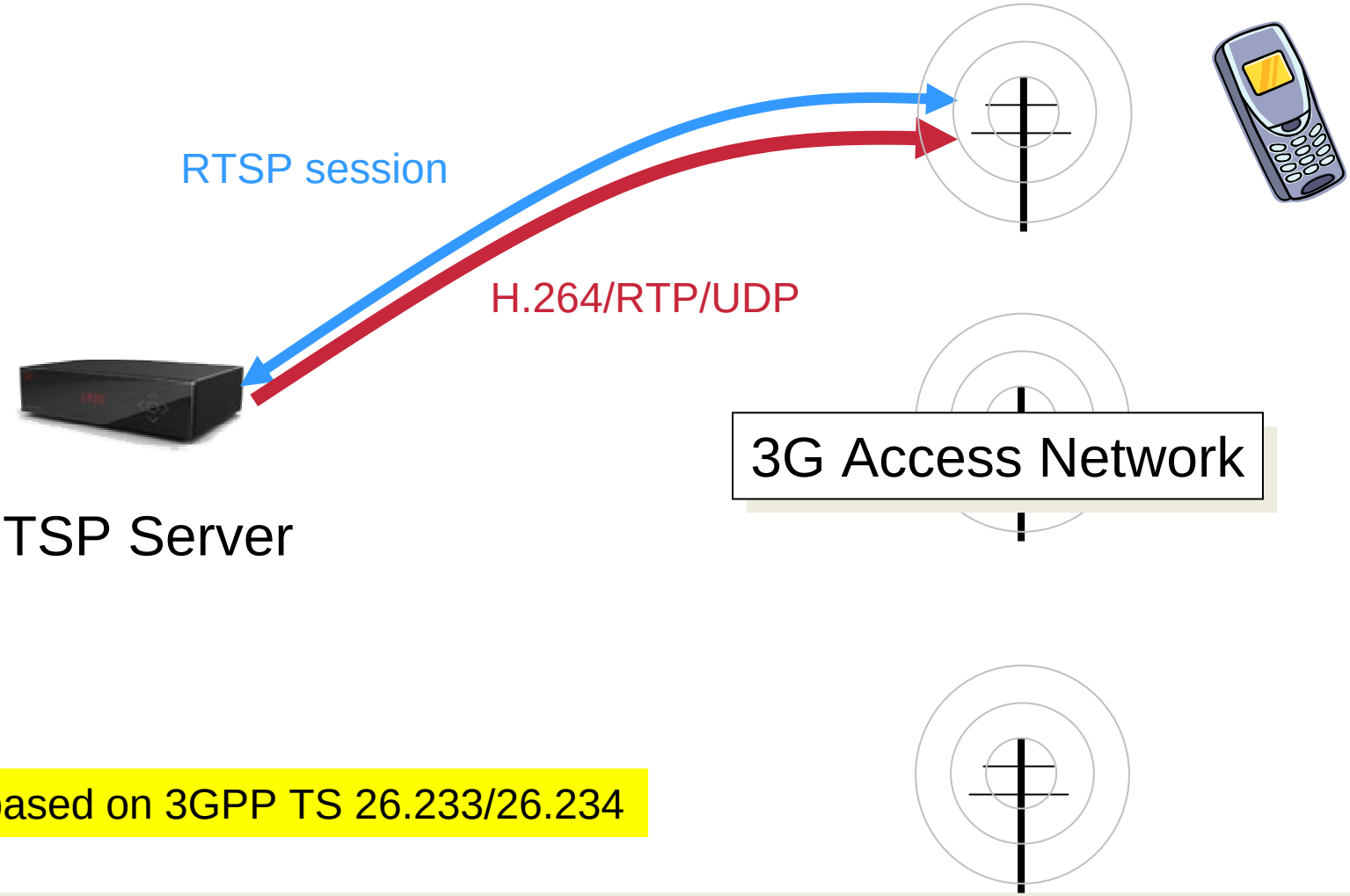
Scenarios

- IPTV Home scenario, via (V)DSL
  - Live-TV (Multicast)
  - Video-Streaming (Video-on-Demand)
  - IMS-like user services (Presence, Reachability) and interaction with telecom services
  - Personalized Video Recorder
  - Personalized Information Streams

Home TV Environment

- Mobile Video/TV on the move, via UMTS/HSPA, WLAN etc
  - Multiple causes for interruptions: technical, social
  - Redirect multimedia stream to mobile device
  - Bridging gaps seamlessly in transmission requires personalization instead of multicast/broadcast services
  - Enriched by personalized information services

Side Note:
3GPP Solution: RTSP-based Mobile-TV



based on 3GPP TS 26.233/26.234

Side Note: 3GPP Solution: RTSP-based Mobile-TV

- RTP und RTSP over 3G data channel
- Optionally: “Fast channel switching”
  - Persistent RTP session
  - Channel switching on server
- Mobility management
  - On 3G layer
  - RTSP session bound to IP address
- Robustness
  - Some robustness by video codec (H.263, H.264)
  - FEC potentially used, but probably not in practice (bandwidth)
- Result: Interruptions not robustly dealt with
  - Blocking video streams
  - Interrupted sessions

Concepts and Tasks (ScaleNet Requirements)

- Session mobility for personalized media streaming
  - Transferring personal video streaming sessions between multiple user devices
  - Centralized live-pause approach
  - Adaptation to user device capabilities
  - Information services (news, messages)
- Robust video streaming
  - Disruption-tolerance support beyond codec and RTP robustness features
  - Support for interrupting and resuming sessions at arbitrary times
  - Support for varying paths characteristics (bandwidth) by content adaptation
- Integration with other personal information services
  - Presence and Messaging
  - Access to web-based media resources

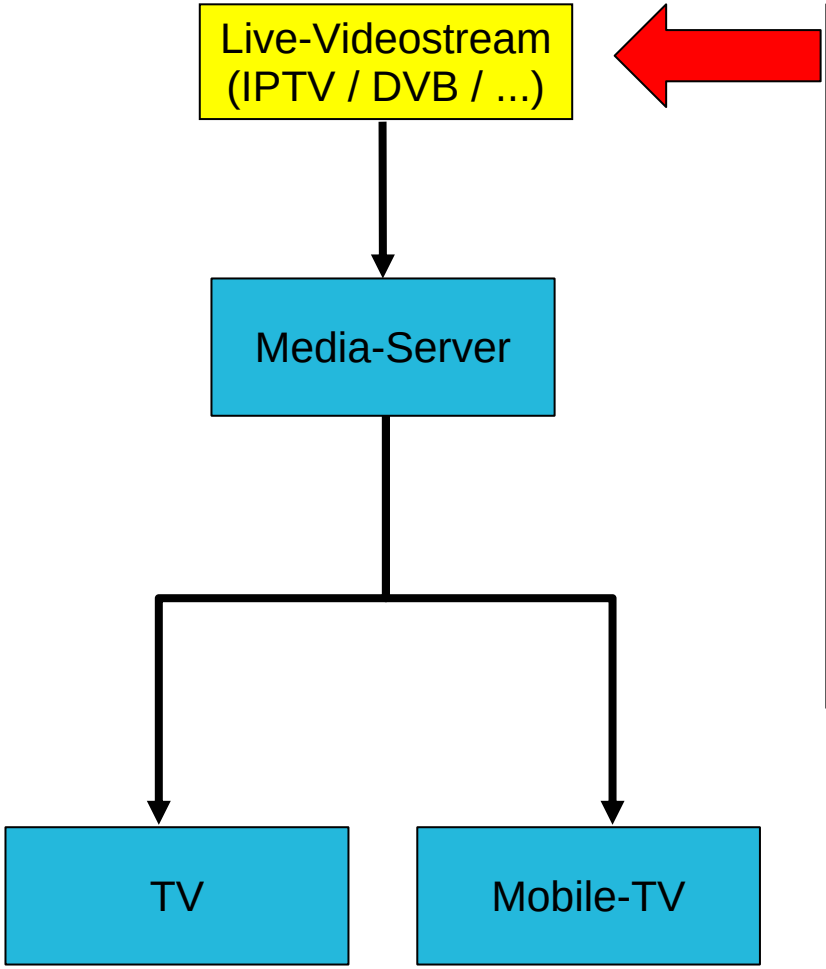
Session Mobility

- Requirements
  - Personal session
  - Suspend-resume capabilities
  - Independent of device, network access
- Approach
  - Multi-user concept on streaming servers and shared client devices
  - Handover support (between user devices)
  - Adaptation to specific device capabilities

Robust Video Streaming

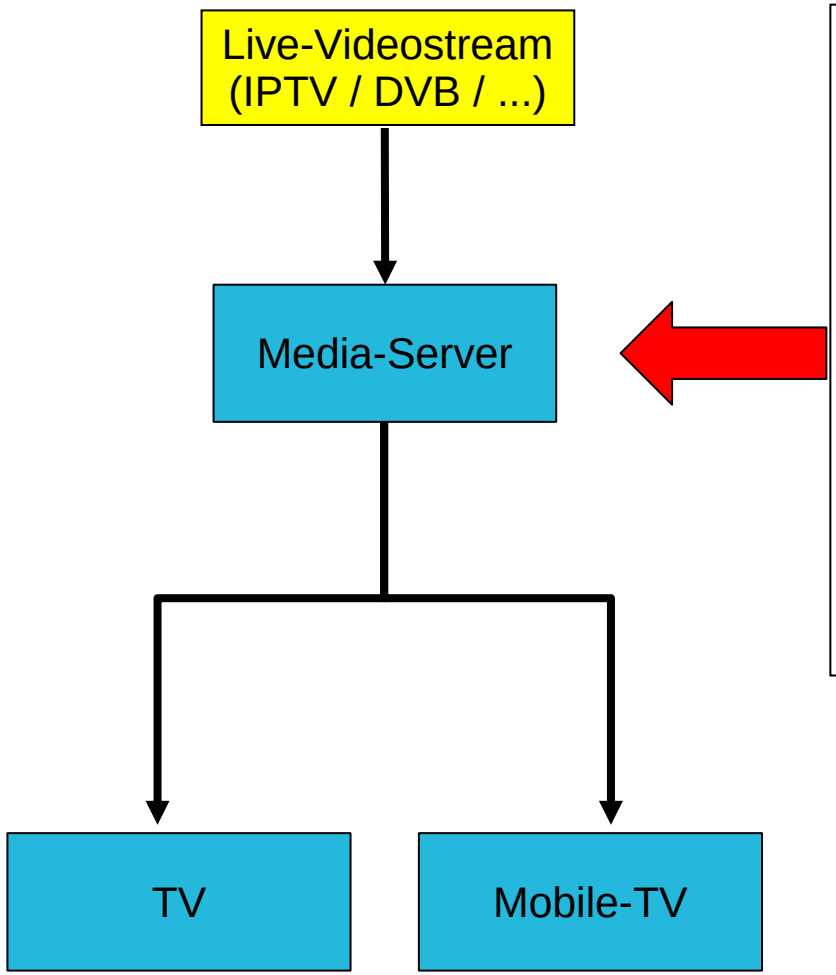
- Requirements
  - Tolerate disconnections and varying network characteristics
  - Streaming session independent of user device and current point of network attachment
- Approach
  - Session concept for video streaming
  - Video chunk based distribution instead of real-time streaming
  - Server and user device maintain user's session state (playout time)
  - Session state independent from transport session state

Mitnehm.TV: Video Sources



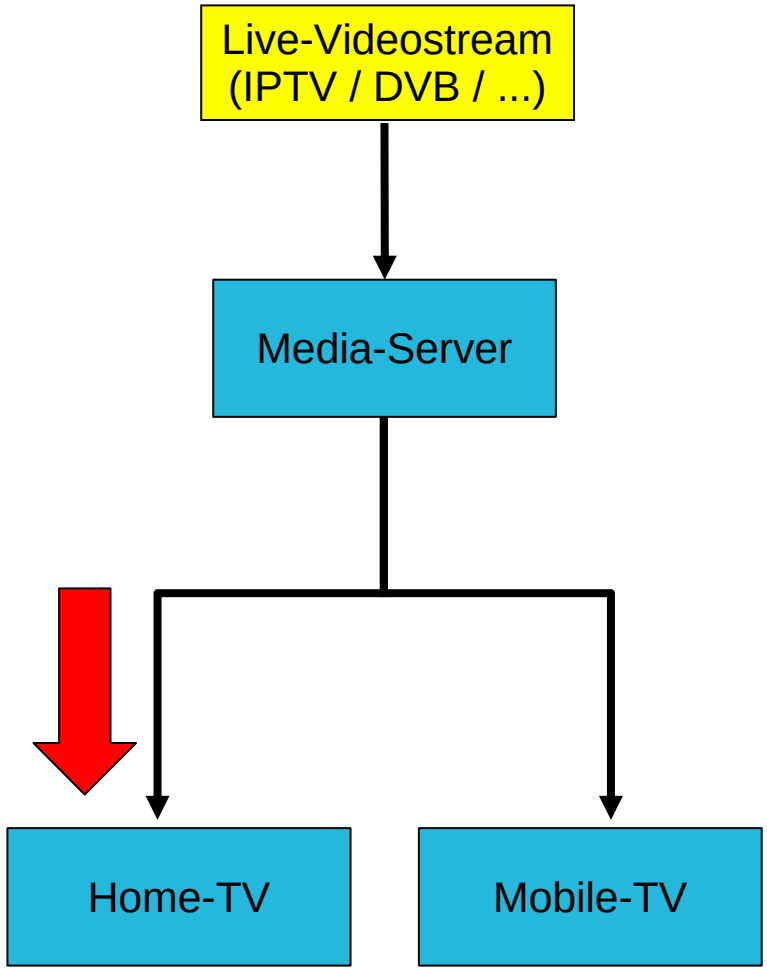
- Arbitrary videostream
  - DVB-T/S/C
  - Analog TV
  - IPTV
- Other videosource
  - DVD
  - Local file

Mitnehm.TV: Media Server



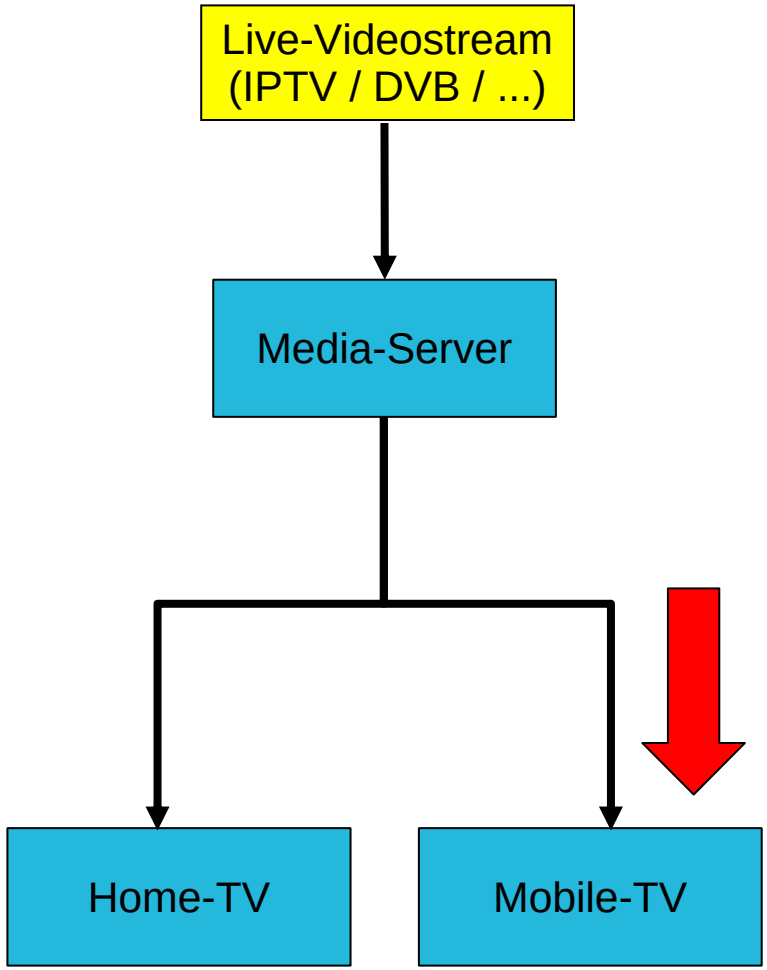
- Records everything into a ringbuffer (for timeshifting)
- Offers program guides (EPG)
- Offers media streams
- Dynamic re-encoding
- Stores users last state (channel + time)

Mitnehm.TV: Home-TV



- Playback of videostreams
- Update userspecific playback state (channel and playtime)
- Show program guide

Mitnehm.TV: Mobile-TV



- Continue playback from last state
- Requests videostream from server
- Regularly send state updates to server
- Prefetch buffer, to compensate
  - Connection loss
  - Lower throughput periods
- Request reduced quality

Robust Video Transport

- From Real-time-Streaming to Video-Chunk-Delivery
  - File-transfer paradigm for video-streaming
  - Reliable transport sessions (here: HTTP/TCP)
  - Client requests video chunks starting from specific timestamps
- Opportunistic network usage and aggressive buffering
  - Use network resources as they become available
  - Try to buffer as much data ahead of time as possible
  - Use buffered data during disconnection times
- Suitable codecs and video file formats
  - Disruption-friendly codec required
  - Video file formats instead of RTP payload formats
  - Different formats available: AVI, MP4, Matroska
  - Not all of them are suitable for streaming mode of operation

Video Codecs

- Codec requirements
  - Efficiency, compatibility with existing players and encoders
  - Disruption-friendly: seeking in video-streams without requiring too much history
- Current state-of-the-art for 3G video streaming: H.264 (MPEG4-Part10)
  - Most efficient codec available today
  - Modular specification – not completely implemented
  - Does not require intra-frames at regular intervals – difficult to achieve random seek with available encoders
- Mitnehm.TV solution
  - MPEG4-Part2 (with codecs such as DivX, Xvid)
  - Less efficient compression but more robust for disrupted usage and better software player support

Video Container Formats

- Format requirements
  - Streamable: seeking within video stream
  - Disruption-friendly: resume interrupted sessions
  - Support for Live-TV: Streaming of not-yet-finalized video files
- Current state-of-the-art for 3G video streaming:
  H.264 and AAC over RTP (MPEG4-Part8)
  - Real-time packet stream at continuous rates
  - Not applicable for opportunistic network usage and disruption-tolerance
- IPTV approach: MPEG Transport Streams (MPEGTS)
  - Currently defines for MPEG-1 and MPEG-2
  - DVB-S2 defines H.264 in transport streams, but not commonly supported by players to date
- Mitnehm.TV solution
  - File format based approach

File Format Based Transport

- Proposed file format for MPEG4: MP4
  - Typically used with H.264 and AAC (based on QuickTime's MOV format)
  - Implemented in most current multimedia phones
  - However: not streamable!
  - `Sample to Chunk Box` and `Chunk Offset Box` index headers required by container format
  - Cannot send video file while it is still being created
  - Also: insufficient support for dynamic cutting (resume)

- Mitnehm.TV solution
  - Matroska file format developed by CoreCodec
  - Designed for streaming of live content: optional index
  - Supports adding dedicated video frames to facilitate cutting and resuming
  - Supported by some software players

матрёшка
MATROSKA

CORECODEC
COREPLAYER™

Implementation

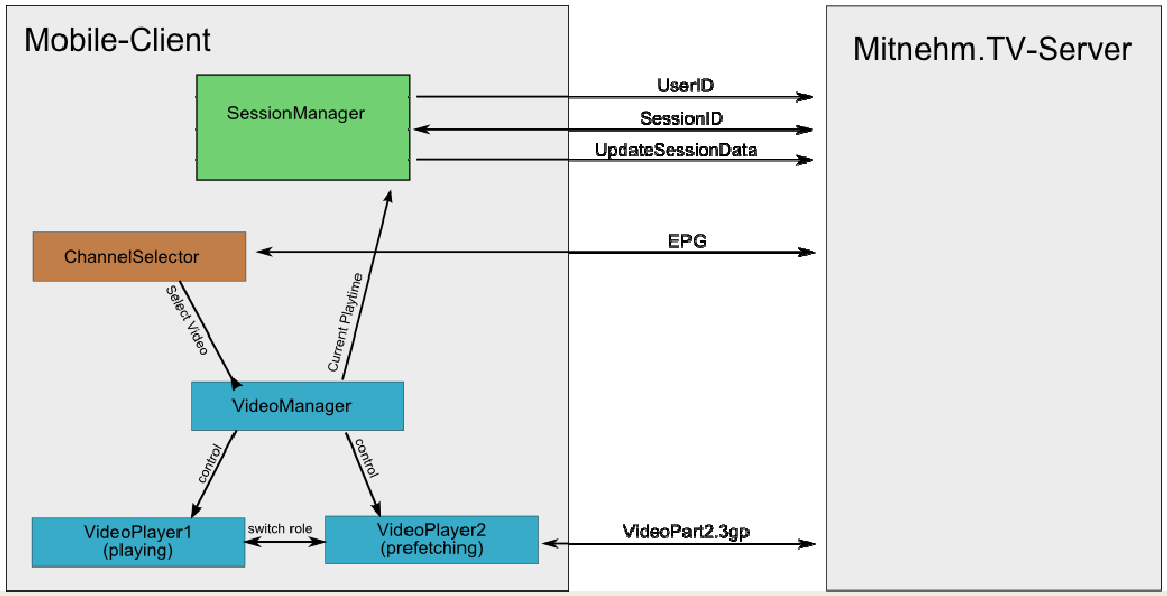
- Settop box client
  - Based on Freevo, TZI's home theater platform
  - MPEG4-Part2 @ 720x576, 25fps, Matroska format
  - Bitrate: 1 MBit/s for video, 128 KBit/s for AAC audio

- PC platform client
  - Touchscreen-based GUI, 1024x768
  - UMTS-HSDPA (Qualcomm chipset)
  - MPEG4-Part2 @ 320x240, 25 fps, Matroska format
  - Bitrate: 300 KBit/s for video, 48 KBit/s for AAC audio

- Mobile phone client
  - J2ME-based
  - MPEG4-Part2 @ 352x288, 15 fps, MP4 format
  - 60 KBit/s for video, 12.2 KBit/s for AAC audio

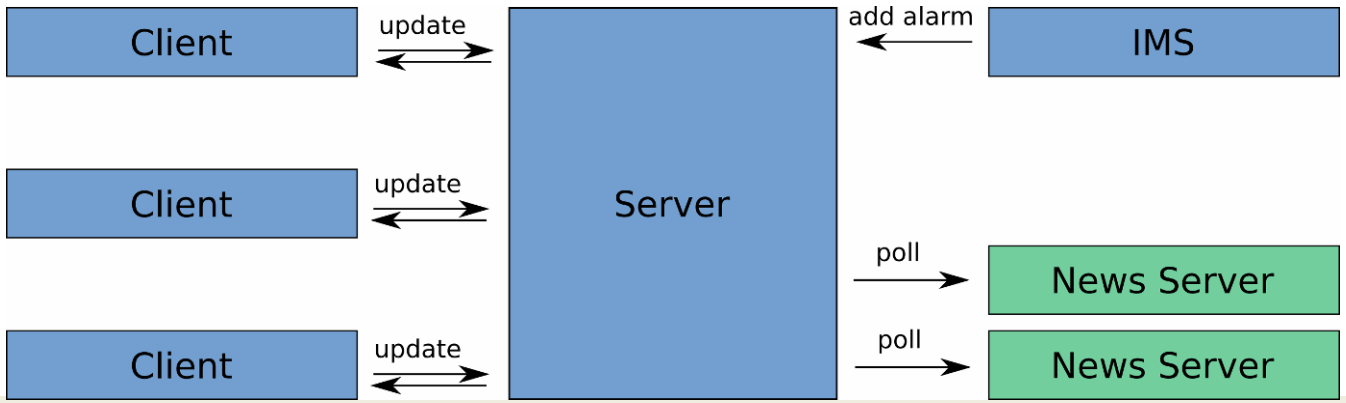
Mobile Phone Implementatior

- GUI approach: J2ME client
  - Phone look and feel
  - Similar interface to the server
- Some adaptations
  - Mobile phone limitations with streamed files: cannot use dynamic pre-fetching
  - Chunks of 60 seconds with parallel download and playout
  - MP4 container format



Integration with Other Personal Information Services

- Objective: creating a blended services platform centered around Mobile TV
- Personal News ticker
  - Interface to RSS/Atom feeds
  - Server monitors feeds and notifies client asynchronously upon changes
- Integration with SIP-based presence services
  - Interface for external services on server side
  - Asynchronous events such as alarms, personal presence state changes etc.



Conclusions

- Personalized video services important differentiated service in future mobile TV service set
- Robustness and disconnection-tolerance important for enhancing usability in mobile scenarios
- Approach: moving from real-time streaming to chunk-based transport
- Mitnehm.TV: a pragmatic solution for demonstrating future converged network based service potentials
- Fully implemented prototype for UMTS-HSDPA and WLAN-based access networks
- Outlook:
  - Improve opportunistic network usage
  - Standards-based IMS integration
  - Richer set of video services (e.g. Video-Podcast support, adaptors to YouTube etc.)

Danke!

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