Video over Mobile Infrastructures

Amos Kohn
October, 2008
Video will be one of the Killer-Apps (on Mass Market) of the Current and Next generation cellular networks (3G / 4G / WiMAX).

Cellular networks inherent BW constrains will require better video/network optimization to serve the expected demand for multimedia content and advertisement.
Challenges

- Access BW constrains $\rightarrow$ More video streams per cell (e.i. 50%)
- Dynamic Network load $\rightarrow$ Dynamic Graceful Degradation/Upgrade
- Multiple formats/resolutions
- Maintain video quality including UGC
- Integration with RAN/ ASN (controller $\leftrightarrow$ processor)
- Cost effective solution
- Scalability
Assumptions

● Mobile broadcasting
  - MBMS – not relevant
  - DVB-H /ISDB-T/ DMB → core
  - Broadcast applications – ads, SDV, PVR, push VOD etc’ – to be farther examined

● Mobile Unicast
  - 3G, LTE (4G GSM)
  - Wimax(4G)

● Internet over mobile
Application requirements

Product:

- Content adapter – SVC /Trans-coder/ trans-rater -> frame rate and resolution adjustment and video resizing
- Bandwidth optimizer
- Maintain QoS
- Integrated with the RAN (Radio Access Network)/ASN ()
- Client/server based (controller / processor)
- Real-Time /Off-Line (VOD)
<table>
<thead>
<tr>
<th>Requirements</th>
<th>Solution</th>
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<tbody>
<tr>
<td>More video streams per cell</td>
<td>Real time</td>
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<td></td>
<td>● Advanced Stat-Mux (between channels over the cell), (Processing pump/ video streaming - according to SLA/ priority)</td>
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<td>Off-line</td>
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<td>● SVC, DPI, (indexing for dropping - advanced preparation required), (integration with VS)</td>
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<td>● Graceful degradation – according to priority/ SVC indexing</td>
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<td>Multiple formats/resolutions (content providers to 3G/ 4G networks and end devices)</td>
<td>Real time</td>
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<td>● Rate/ format adaptation, resolution and video resizing, IP data encapsulation</td>
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<td></td>
<td>● SVC encoding (integration with VS)</td>
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<td>● Indexing</td>
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<td>Requirements</td>
<td>Solution</td>
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<tr>
<td>Dynamic changes of network loads</td>
<td>• Advanced Stat-Mux</td>
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<td>• Smart b/w management</td>
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<td>Maintain video quality</td>
<td>Real-time</td>
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<td>• Look-ahead for rate-control mechanisms SM</td>
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<td>Off-line</td>
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<td>• Generate metadata for real-time quality estimation (advanced preparation/ indexing required)</td>
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<td>• Pre-processing – (advanced preparation/ indexing required)</td>
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Tech requirements

- Stream adaptation will be performed in several different ways to support heterogeneous networks and diverse user terminals. Such mechanism will apply multiple techniques dynamically to achieve the best results:
  - Adaptation of spatial resolution
  - Spatial quality
  - Temporal frame rate
  - Sequence duration
  - Spatial domain transcoding (requantization of DCT coefficients and DCT coefficients dropping)
  - Temporal domain transcoding (frame dropping)
  - Object-based transcoding (video object prioritization and dropping)
  - Frame-Layer bit allocation (scene context statistics from the incoming video stream can be utilized to detect scene changes and determine frame type)
  - Macroblock layer rate control (linear rate-quantization model can be used to select quantization parameters for macroblocks)
  - Other scalable coding tools in MPEG-4 also enable the dynamic rate adaptation

- Adaptation algorithm will be used to adjust the bit-rate of video data in response to the network bandwidth available and the user terminal capabilities
**Tech requirement**

- **Video resolution:**
  - The stream resolution will be dynamically change to accommodate user terminal capabilities and network constrains

- **Stream resizing**
  - Resize filter will be used for resample or cubic interpolation. It will calculates the new value of a pixel based on an examination of the surrounding pixels

- **Multi format processing:**
  - H.264
  - H.263
  - VC-1
  - WMV
  - FLV
  - QT
  - SMIL

- **Minimum resolution:**
  - 176 x 144 / 15 (QCIF)

- **CDN/Caching:**
  - To support near-real-time and VOD rate adaptation and video resizing, a cache with replacement algorithm should be applied in the system solution
Tech requirements

- The stream manipulation will be performed at the following locations:
  - WiMAX: at the Access Service Network (ASN)
  - UMTS: at the Radio Access Network (RAN)

- **Network feedback control**
  - Rate adaptation will be applied on a stream in real-time when a user log-in to available multimedia content/application
  - The trigger to dictate stream adaptation is the same trigger that starts unicast stream (by the user (terminal))
  - The bit rate and quantization level of a stream will be dynamically adjusted in response to the control parameters that will be imbedded in the network feedback control

- **The network feedback control metadata will contain the following information:**
  - Unicast IP
  - Network condition (infrastructure type, available bandwidth)
  - User device type (video resizing requirement). Note: server may contain database of CE devises vs. resolution/resizing supported
  - Stream conditioning adaptation changes requests
Environment

- **Major Customers / End users**
  - MVNOs
  - MNOs

- **Major Partners / sales channel**
  - Alvarion
  - WiNetworks
  - Airspan
  - Lucent-Alcatel
  - Nokia Siemens

- **Geographies**
  - Asia
  - EMEA
  - US
SDV solution for broadband TV over mobile
Strategy Affect of the Market

- SDV will enable to deliver more broadcast content
  - Mobile phone users experience will be similar to other broadcast services such as digital cable or satellite
  - Users will be able to watch a variety of live television programs, traffic reports, movie clips, music videos, listen to digital music
  - View a variety of entertainment and content options

- SDV will provide efficient BW saving
  - Broadcast programs are terminated at the Core Network and at the Radio Access Network
  - BW saving in both wireless and interconnect networks
  - BW adaptation will be applying at the edge to allow service enhancement

- Enrich Content
  - Combine multicast with unicast targeted content. I.e. allow replacement of multicast program (broadcast) with unicast program (targeted ad)
  - Roaming of local station chasing the user on the move
High Level Solution

- **Systems:**
  - DVB-H
  - MediaFLO
  - WiMAX

- **Video resolution:**
  - QVGA up to 30 fps 240x320 pixels

- **BW efficiency:**
  - DVB-H: 8 channels, 6 MHz ~ 300kbps each
  - MediaFLO: 20 channels, 6 MHz ~ 300kbps each

- **Services:**
  - DVB-H 20 to 30 channels on 25 MHz spectrum (3x5)
  - MediaFLO 60 channels on 12 MHz spectrum (2x6)
  - WiMAX: 40 channels unicast + 50 multicast

- **Stream aggregation:**
  - Re-encoding framerate reduction at the National Operation Center
  - Open loop statmux at the Local Operation Center
High level Solution

- Encompasses all input stream type i.e. CBR/VBR
- Stream adaptation to accommodate roamed stream supporting cell phone on the go and available BW on particular cell
- Dynamic stream mapping
- SRM integrated with media GW and packet data traffic signaling as part as the SDV Session Server
- Stream routing controlled by SRM via routing network
- Two level of multicast termination:
  - IP/MPLS
  - Radio Network Controller
- Personalized and targeted ad insertion at the edge
- Stat-muxing
- Encryption at the edge/Bulk encryption??
- Local cache for to support rollover and pause live TV
- Cell phone SDV client – channel Change Protocol (DSM-CC??)
- Mini carousel both upstream and downstream to update SDV client on the cell phone as well as core network broadband multicast switch
- Session building management interface with WiMAX/UMB/UMTS based station
SDV over MediaFLO Network

- **National Ops Center**
  - Internet
  - NOC H.264 QVGA Transcoding
  - National Content Provider

- **Local Ops Center**
  - Internet
  - National + Local Multicast
  - National Content Provider
  - Local Content Provider

- **Wireless Network**
  - Base Station
  - UERM
  - SDVSM Mini Carousel Session Bdg
  - Stream Adaptation Statmux
  - 3G Network Services & Subscription

- **Mobile User**
  - Mobile
  - New Backend
  - 3rd Party
Proposed Goto Market Strategy

- Define first strategic accounts and alliances with integrators
  - ALU and North America (AT&T), EMEA
- Get to definition of product, integrated with integrators
- Buy what we need to buy
- Focus on specific solutions, but across geographies
- Become best of breed in those areas we go for
- Allow lower margins for new solutions/edge architecture
- Timeframe by nature will shift, but need to maintain strong relationship with partners
- Create Joint Marketing-Development Technical Research Group
- First deliverables in 12M (alpha)
- Maintain visibility even as OEM as exit strategy and share value increase