Broadband Multimedia Provision via Satellite: Status, Possibilities and Challenges

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- The demands of the broadband user
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- The evolving broadband access scenario
- Triple play and beyond
- Downlink/uplink requirements
- An optimal system for triple play
- Beyond triple play. From centralised to interactive services
Background

- For broadband multimedia The combination DVB-S/DVB-RCS has been introduced and tested.
- It is neither cost efficient nor user friendly.
- Discussions for improvement ongoing (adopt to DVB-S2, use DOCSIS etc).
- Is this evolutionary approach good enough.
- There is also a broadcast development in the terrestrial network, providing TV (Triple play).
- What will we need in 2012-2015?
Traffic Characteristics

- Traffic is dominated by a small fraction of the users and there is enormous variations between users.
- Degree of symmetry varies with type user, is a function of traffic volume and.
- The heavy user has more outgoing traffic, relatively.
- There is traffic all day.
- A system must be flexible with regard to downlink/uplink capacity.
## User traffic Segmentation

<table>
<thead>
<tr>
<th>Fraction of total User Group of 2242 HH</th>
<th>Traffic characteristics</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total Volume in GB</td>
<td></td>
</tr>
<tr>
<td>Top 1%</td>
<td>103</td>
<td>2.27</td>
</tr>
<tr>
<td>Top 5%</td>
<td>41</td>
<td>1.83</td>
</tr>
<tr>
<td>Group 1</td>
<td>13</td>
<td>1.79</td>
</tr>
<tr>
<td>Group 2</td>
<td>0.5</td>
<td>0.47</td>
</tr>
<tr>
<td>Group 3</td>
<td>0.13</td>
<td>0.26</td>
</tr>
<tr>
<td>Group 4</td>
<td>0.04</td>
<td>0.18</td>
</tr>
<tr>
<td>Group 5</td>
<td>0.01</td>
<td>0.15</td>
</tr>
</tbody>
</table>

Source: Bredbandsfabriken

Total traffic: 1884 GB in 2 weeks. Average per user 840 MB.
Example on variations in outbound and inbound traffic for mixed user group

Users: 1 school, 1 library, 1 SME and 4 HHs
Traffic pattern for SME
Traffic indicators

- Traffic increases when capacity becomes available.
- The total volume is mainly used by a minority of the users and it is probably this group leads the development of new services.
- The ability to offer transport resources allowing for asymmetric traffic in either direction is important.
- A combination of users that results in a relatively constant resource utilisation all day should be sought.
Representative contributions to the daily traffic scenario

<table>
<thead>
<tr>
<th>Services</th>
<th>Total use (min/day)</th>
<th>Average Down (kbit/s)</th>
<th>Average Up (kbit/s)</th>
<th>Volume Down (kbps)</th>
<th>Volume Up (kbps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Telephony</td>
<td>15 (20)</td>
<td>16</td>
<td>16</td>
<td>1800 kB</td>
<td>1800 kB</td>
</tr>
<tr>
<td>WEB/email</td>
<td>60 (70)</td>
<td>200</td>
<td>64</td>
<td>90000 kB</td>
<td>28800 kB</td>
</tr>
<tr>
<td>Data</td>
<td>10 (30)</td>
<td>512</td>
<td>512</td>
<td>38400 kB</td>
<td>38400 kB</td>
</tr>
<tr>
<td>Audio streaming</td>
<td>100 (115)</td>
<td>40</td>
<td>16</td>
<td>30000 kB</td>
<td>12000 kB</td>
</tr>
<tr>
<td>Video</td>
<td>50 (100)</td>
<td>512</td>
<td>16</td>
<td>192000 kB</td>
<td>6000 kB</td>
</tr>
<tr>
<td>Real time A/V</td>
<td>10 (10)</td>
<td>512</td>
<td>512</td>
<td>38400 kB</td>
<td>38400 kB</td>
</tr>
<tr>
<td>Broadcast (TV)</td>
<td>240 (300)</td>
<td>5000</td>
<td>0</td>
<td>90000 MB</td>
<td>0</td>
</tr>
</tbody>
</table>
## Tariffing for data in terrestrial systems

<table>
<thead>
<tr>
<th>Technology</th>
<th>Capacity</th>
<th>Euro/month</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADSL</td>
<td>704/128 (kbit/s)</td>
<td>35-43</td>
</tr>
<tr>
<td>ADSL</td>
<td>1024/256 (kbit/s)</td>
<td>57-65</td>
</tr>
<tr>
<td>ADSL</td>
<td>2048/256 (kbit/s)</td>
<td>95-100</td>
</tr>
<tr>
<td>Cable</td>
<td>512/128 (kbit/s)</td>
<td>42-45</td>
</tr>
<tr>
<td>VDSL (triple play)</td>
<td>25/2 (Mbit/s)</td>
<td>100</td>
</tr>
<tr>
<td>Fiber (data) (1)</td>
<td>10/10 (Mbit/s)</td>
<td>90</td>
</tr>
<tr>
<td>Fiber (triple play) (2)</td>
<td>No specific limitation</td>
<td>100</td>
</tr>
</tbody>
</table>

Mainly based on a monthly cost independent of volume!
Tariffing in satellite systems

- The use of the satellite segment and the earth station dominates the cost.
- A strong drive for a volume based tariff or a combined fixed/volume based model.
- Space segment utilisation very critical.
- Broadcast type transponders can give as low as 4-10 cent/MB, 1 GB/month → 40-100 Euro/month (comparable to ADSL at this volume)
- With a 10 times increase in volume there is a problem.
- The satellite must down by a factor 5-10 in transport cost to compete with terrestrial solutions.
Areas for improvement

- The DVB-S/DVB-RCS system.
- Traffic organisation.
- Operational principles (downlink/uplink)
- Interoperability/co-ordination with terrestrial networks.
- User equipment
- Protocol issues and transport organisation.
Satellite in IP networks is needed!

Satellite hop features:
Delay, capacity, link losses, asymmetry (not addressed here)

TCP-IP

Router

User end
Interoperability scenario

- LMDS
- ADSL
- VDSL
- DTT-RC
- Interactive cable
- Footprint of satellite
Characteristic features

- The satellite has large coverage, but low individual capacity.
- The terrestrial networks have high capacity per user, but with limited coverage range per node.
- The satellite will connect directly to users and to cells in the broadband terrestrial access network, there will be a mixture of individual and multicast connections (connections to multiple cells).
- Satellite networks depend on a high utilisation factor. Good for TV, a problem with varying multimedia traffic.
- Satellite multimedia can not take a success that creates a lot of extra traffic.
Roles of multimedia satellite networks

- Delivery into local networks; broadcast, multicast and individual traffic. Broadcast and multicast will create individual return traffic
- Always on requirement
- But on what transport stream. Requires organisation.
- Interactive traffic from local networks to satellite segment
- Combined broadcast and interactive systems
- Users will demand full service offering (including TV, Internet and telephony). This gives the DVB-RCS a central position and low cost and good functionality of that system will be critical
Down link configuration with several transport streams

<table>
<thead>
<tr>
<th>TV + data</th>
<th>data</th>
<th>TV</th>
<th>......</th>
<th>Multi-cast</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 MHz</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

?What transport stream has data for a given user!??
The difficult combination of DVB-S/RCS

- Designed from the sender point of view. OK to put TV and data in, but more complicated for the user who requires flexibility and availability.
- Today's system requires a multichannel receiver to handle 1-3 TV programs, interactive data, always on and multicast simultaneously.
- Much higher capacity in the transport stream could partly contribute to an improved solution.
The user interface

Earth Station

Ku-Ka, Ku-band

Terminals

Simplified residential users of today

SOHO/Business users

Internet

Service providers

Broadcast network
Some requirements from the user

- Must support the combined TV/data usage.
- The interface box should have router functionality and operate into a local distribution network like Ethernet.
- Several users require flexibility with regard to operation on different transport streams.
- Authentication must be with the local device.
The return channel based on MF-TDMA
Return link

- Complex and not user friendly solution.
- To costly.
- The utilisation factor of the return may be a problem. If multicast creates a lot of individual traffic overloading will occur.
- A possible solution is to keep a lot of the interactive traffic in the high capacity terrestrial cells.
- Operates in linear polarisation, requiring a specialist for antenna mounting and line-up.
- Alternative solutions like CDMA (a much wider band allowing for more users).
Development scenario

- Get the DVB-RCS operational
- Existing satellites favour DVB-RCS
- Improve interfacing to the terrestrial networks and look for integration
- Fully IP based solution for the future
- Higher capacity in the transport streams, both up and down.
- The present 2Mbit/s limitation on the uplink a future problem.
- Traffic organisation for improved resource utilization and cost lowering.
Concluding remarks

- It is important to become operational with the DVB-RCS addressing broad groups of users. Existing and planned broadcast satellites will provide the delivery platforms.
- Start with organisations and schools in the first phase
- Higher capacity per transport stream should be considered.
- Cost is a critical issue that will get worse as the individual traffic volume increases.
- The cost issue must be given priority and reflected into equipment cost, architecture, operational principles, efficient and user friendly traffic organisation and adaptability provision of future more community oriented services.
Long term actions

Objective: Keep the transport cost at the level provided by terrestrial systems and provide:

- Flexible interactivity with terrestrial systems.
- Provide an IP based downlink for combined services.
- A router based receiver is one possibility.
- Installation and antenna corrections without the use of experts.
- MP to MP functionality
- Adaptive modulation/coding (location dependent)
- Uplink to replace/improve present MF-TDMA solution.
- First of all: Design a system for efficient provision of Multimedia services in 2012.