MPEG-4 BSAC Technology

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Samsung AIT
Introduction to BSAC

- What is BSAC
  - Bit Sliced Arithmetic Coding
  - *alternative noiseless coding tool for MPEG-4 AAC*
    - *to provide fine grain scalability functionality*

- Characteristics of BSAC
  - High coding efficiency: transcoding of AAC
  - Small step scalability with 1kbps/ch
    - (scalable range: 16kbps/ch ~ 64kbps/ch)
  - Error resilient capability (SBA mode)
BSAC method
- top down scalability
- small step scalability
  with 1kbps/ch enhancement layer
- single decoding pass

Comparison with AAC
**Basic idea of BSAC**

- Bit sliced approach: Slice those quantized data in bit order

<table>
<thead>
<tr>
<th>Spectral data</th>
<th>MSB</th>
<th>LSB</th>
</tr>
</thead>
<tbody>
<tr>
<td>( x(i) )</td>
<td>0 1 0 0 1</td>
<td></td>
</tr>
<tr>
<td>( x(i+1) )</td>
<td>1 0 0 0 0</td>
<td></td>
</tr>
<tr>
<td>( x(i+2) )</td>
<td>0 0 1 1 1</td>
<td></td>
</tr>
<tr>
<td>( x(i+3) )</td>
<td>0 1 0 1 1</td>
<td></td>
</tr>
</tbody>
</table>

- **1 0 1 1**: (Least Significant Vector)
- **0 0 1 1**: (4th Significant Vector)
- **0 0 1 0**: (3rd Significant Vector)
- **1 0 0 1**: (2nd Significant Vector)
- **0 1 0 0**: (Most Significant Vector)
Concept of BSAC bitstream

- **Top Layer**: Layer 1 + Layer 2 + … + Layer N
- **Intermediate layer**: Layer 1 + Layer 2 (1st Enhancement Layer)
- **Base layer**: Layer 1

- Side info. for Base Layer
- Audio data for Base Layer (MSVs)
- Side info. for Layer 2
- Audio data for 1st Enhancement Layer (2nd MSVs)
- Side info. for Top Layer
- Audio data for Nth Enhancement Layer (LSVs)
**SBA mode**

- **Segmented Binary Arithmetic Coding**
- provides error resiliency
- partitions the arithmetic codeword into some sections
- provides very little overhead (less than 1 %)

**Decoding concept of SBA mode**
Performances of BSAC

Source: ISO/IEC JTC1/SC29/WG11/w3075
(Report on the MPEG-4 Version 2 Audio Verification Test)
Streaming service with BSAC

- reduces a burden of the Server
  - have only one bitstream
Streaming service with BSAC

- reduces a burden of the Router
  - do not need a transcoding
Streaming service with BSAC

Network A

- 100Mbps LAN
- 1Mbps ADSL
- 128kbps ISDN

Active Router

Network B

- 64kbps
- 56kbps

Network C

- 96kbps
- 80kbps

MOD Server

● reduces a burden of the Server
  - have only one bitstream
● reduces a burden of the Router
  - do not need a transcoding
QoS with BSAC

Menu order
If you pay 10¢
If you pay 20¢
If you pay 30¢
If you pay 40¢

Food
QoS with BSAC

**Menu order**

- If you pay 10¢
- If you pay additional 10¢
- If you pay additional 10¢

**Food**

- Shark

108th AES Convention
QoS with BSAC

Audio client 1
Audio client 2
Audio client 3
Audio client 4
Audio client 5
Audio client 6
Audio client 7
Audio client 8
Audio client 9
Audio client 10

LAN 100 MHz
ISDN 2048kb/s
http server
GSTN
Proximity Router
1024kb/s
64kb/s
64kb/s
64kb/s
64kb/s
128kb/s
128kb/s
128kb/s
128kb/s
128kb/s

108th AES Convention
QoS with BSAC

Picture of a network diagram with various nodes including audio clients, servers, and routers connected through different networks such as LAN, ISDN, and GSTN. The diagram shows the flow of data with bandwidths indicated in kilobits per second (kb/s). The diagram includes nodes labeled with "Audio client 1" to "Audio client 11," "http server," "Audio server," and "Proximity Router."
QoS with BSAC

108th AES Convention
Conclusions

- Alternative noiseless coding tool of MPEG-4 AAC
- Fine grain scalability with 1kbps/ch
  - with graceful quality degradation
  - with top down scalability
- High coding efficiency at top bitrate
- Error resilient capability
**Demonstration-1**

- Item: 48kHz, mono, 64kbps ~ 40kbps

![Graph showing bitrate (kbps) over time (sec.)](image-url)
Demonstration-2

Item: 32kHz, stereo, 96kbps ~ 64kbps

Bitrate (kbps)

96

64

Time (sec.)

2 4 6 8 10 12 14 16