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“Vision and User experience”

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Who am I?
VQEG – Video Quality Experts Group
Historical …

3D TV set unit shipments will reach over 100 million in 2015, comprising more than 1/3 of all DTV sets shipped worldwide.

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Video is an essential part of everyone's lives.
Mobile Video Is Exploding

Consumer

649.8M
2011
8.8x
86.4M
2016

Revenue

4591M
2011
7x
686M
2016

Traffic

7614 PB/month
2011
25x
310 PB/month
2016

Source: ABI Research *
Source: ABI Research *
Source: Cisco VNI *

Quality, Network Efficiency, and Cost/Revenue ($$/bit) are Critical
New Media Services Are Emerging

Deliver good QoE for any service, anytime, anywhere, on any device

- Interactive video
- Video sharing
- Live streaming
- Video conferencing
- Video-on-demand
Other Vision Related Research
Classmate PC
Challenges for Vendors

Video Delivery Ecosystem

- Technology Provider
- Content Provider
- Network Service Provider
- Client
- App Developer

Video Delivery Ecosystem Logos:
- BBC
- Hulu
- ESPN
- HBO
- CBS
- Netflix
- comcast
- frontier
- T-Mobile
- Sprint
- verizon
- at&t

Device Logos:
- Android
- devi
- Windows
- Mac
- iOS

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Good QoE Solution Established Through Subjective Mapping
Why Subjective Testing?

Current Solutions Ask...

- What is the resolution?
- What is color gamut?
- What is the frame rate?
- How many pixels?

What Solutions Should Ask...

- What does the person sitting in front of the screen think?
Subjective Testing Methodology

Rich Video Content

Compression
- Bitrate
- Resolution

Compress

5-point scale

Excellent
- 6Mbps@1080p
- 3Mbps@720p
- 1Mbps@480p
- 500kbps@360p

Good
- 30

Poor
- 30

Form Factors
- HDTV
- Tablet
- Phone
Learning from Subjective Results

- Subjective Quality = Bitrate?

Bitrate ≠ Subjective Quality
Current Objective Quality Metrics

- PSNR (Peak-Signal-to-Noise Ratio)
- MS-SSIM (Multi-Scale Structural SIMilarity)

Mathematical Model to Approximate Subjective Quality
Subjective Quality Estimator

Content Analyzer

Spatial details (S)

Low → High

Motion level (M)

Low → High

Objective Quality Calculator

MS-SSIM

QoE Estimator

QoE = α MS - SSIM + β

Device Features

Display resolution (R)

800x480
1280x720
1920x1080

Display devices (D)

Estimated Subjective Score
Relevant Application and Ecosystem Impact
Application of Subjective Quality Estimator

Input Video

Content Analyzer
Objective Quality Calculator
Device Features

Video Codec
QoE Estimator

Encoder Settings
- Bitrate
- Resolution
- Frame rate
- GOP structure
- Coding modes
- .......

QoE @ R

Yes

Compressed Video

Video Adaptation to Provide QoE Management

No
QoE Management

- QoE across different content and devices
  Goal: Very Satisfying User Experience

<table>
<thead>
<tr>
<th>Device</th>
<th>Bitrate</th>
</tr>
</thead>
<tbody>
<tr>
<td>iPad*</td>
<td>4Mbps</td>
</tr>
<tr>
<td>iPad*</td>
<td>1.5Mbps</td>
</tr>
<tr>
<td>iPhone*</td>
<td>1Mbps</td>
</tr>
<tr>
<td>iPhone*</td>
<td>330kbps</td>
</tr>
</tbody>
</table>
Tier Services

Bitrate = 2Mbps, iPad*
Satisfying

Bitrate = 4Mbps, iPad*
Very Satisfying
Looking Forward: Video Quality Metrics Across the Ecosystem
Shift in the Media Ecosystem

There must be a successful shift from

Quality of Service

to

Quality of Experience
Questions?
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