International Telecommunication Union

Towards a Standardised Perceptual Quality Metric for Multimedia

David Hands

Perceptual Engineering Group

BT

ITU-T VICA Workshop
22-23 July 2005, ITU Headquarter, Geneva

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Overview

- Emerging video services
- Need for objective quality metrics
- VQEG Multimedia ad-hoc group
- Timeline
- Sample metric

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Emerging video services

- New services in Asia, Europe and N. America
- Infrastructure ready for video/multimedia (codecs, networks, devices)
- Services
  - Streaming video, VoD, Video telephony, TVoDSL/IPTV, mobile TV
- Service Providers
  - HomeChoice, Neuf, Fastweb, SBC, Verizon, NTT, Vodafone, …
- Networks
  - NGNs (e.g. BT), increasing b/w, fiber to the home, wireless networks (802.11a/b/g/n, Wi-Max), 3G mobile
  - high quality services offered on cost-effective networks providing multi-service access (any service to any device from anywhere)

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Need for objective quality metrics

- Measurement of user experience is essential to the industry
  - defining quality thresholds of media prior to launch
  - selection of equipment and packaging of content
  - attracting and maintaining customer base
- Traditional quality measures are inadequate
  - PSNR
  - Network QoS
- Requirement is for objective perceptual metrics

Objective perceptual quality metrics

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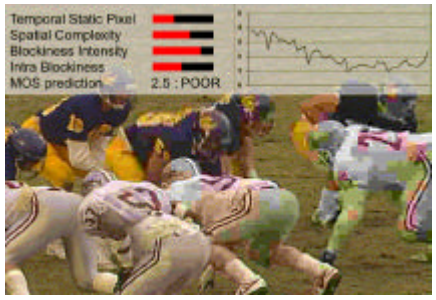
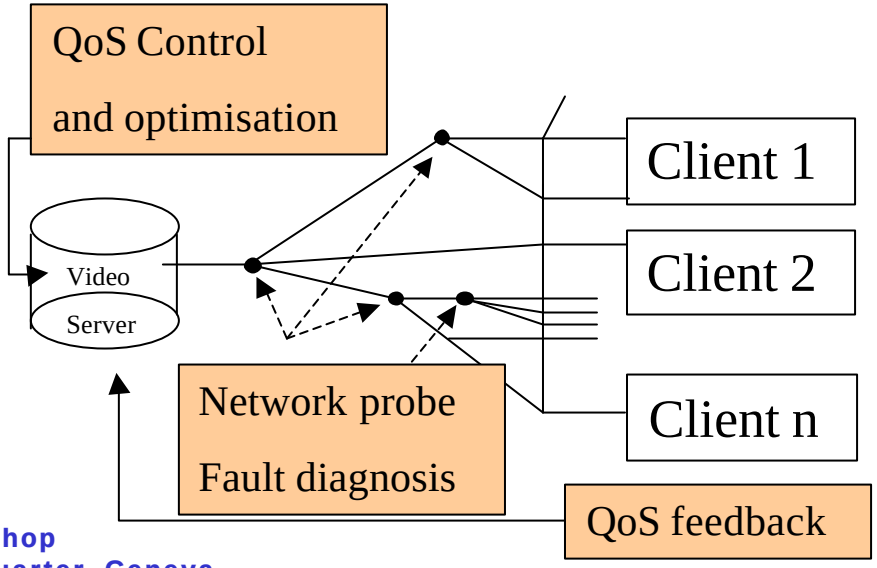
- Perceptual quality is
  - content-dependent
  - codec dependent (e.g. codec settings, decoder error handling)
- Performance testing
  - codec evaluation
  - quality profiling
    (e.g. content x bit-rate x frame rate)
  - network dimensioning
- In-service monitoring
  - E2E quality monitoring
  - SLA negotiation and policing
  - Fault identification





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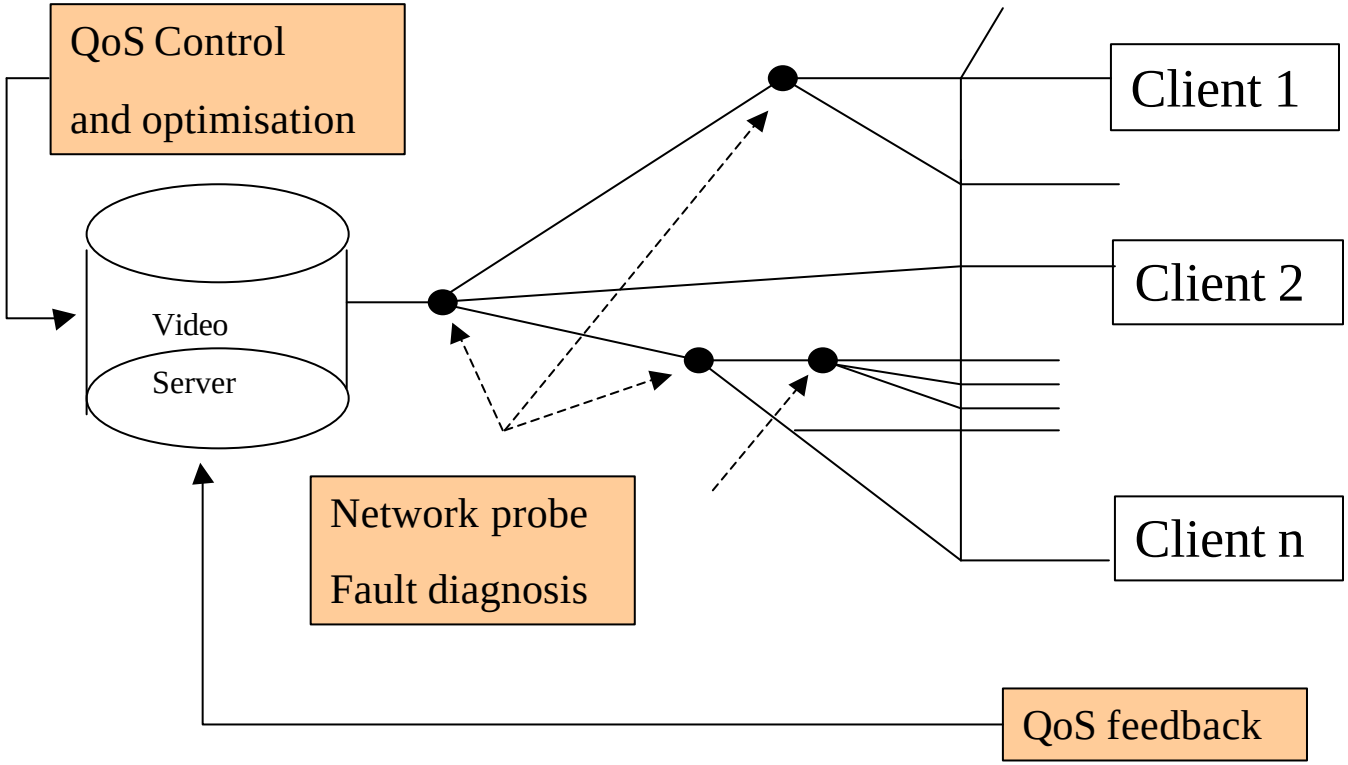
QoS Control
and optimisation
Video
Server
Client 1
Client 2
Client n
Network probe
Fault diagnosis
QoS feedback

VQEG Multimedia ad-hoc group

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- VQEG FR standards
  - ITU-T Rec. J.144 and ITU-R BT. 1683
  - specific to digital TV (MPEG-2)
  - for video containing compression errors

- VQEG MM
  - Goal is to evaluate objective metrics
  - FR, RR, NR models
  - 3 stages: video only, audio only, audio-video
  - set ambitious testing requirements

Scope of VQEG MM Stage 1

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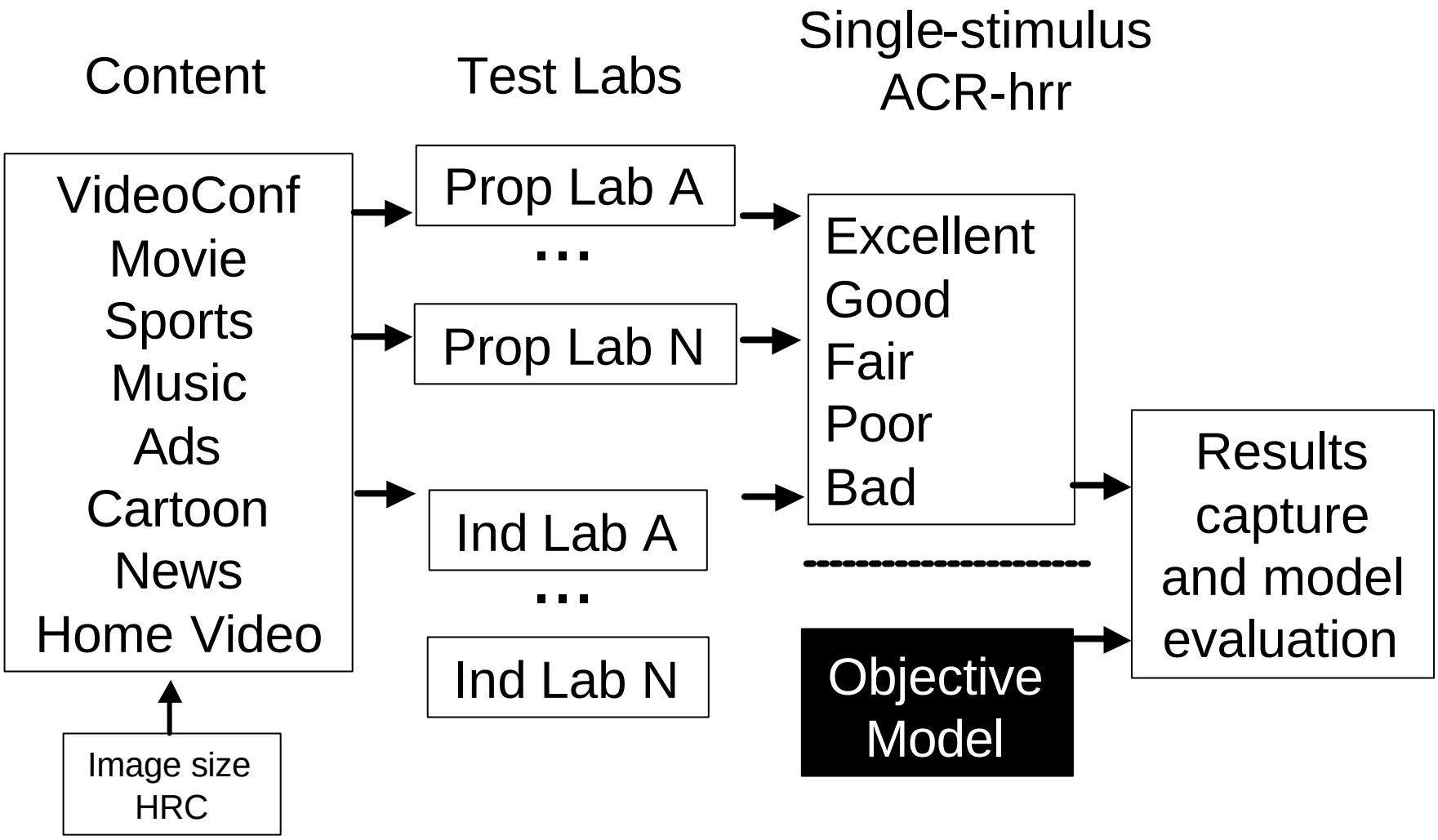
- Video test
- Image sizes: CIF, QCIF, VGA
- Display: high performance LCD
- Viewing distance: variable within 6-10H / 6-8H / 6H
- Codecs: WM9, RV, MPEG-4, H.263, H.264
- Range of frame rates (30fps - 2.5 fps)
- Error conditions:
  - compression errors
  - compression x transmission errors
  - post-processing
  - live network conditions

Test Process



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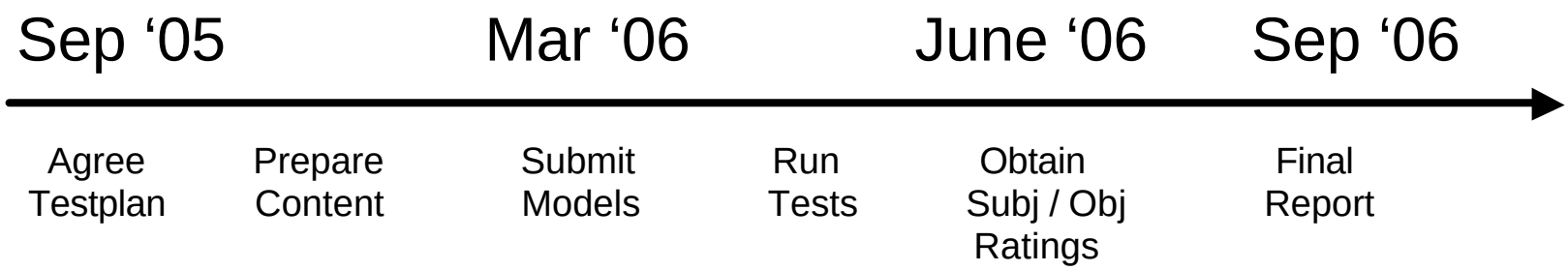
Timeline



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Multimedia Perceptual Models

- Industry
  - BT
  - Genista
  - KDDI
  - NTT
  - Opticom
  - Psytechnics
  - SwissQual
  - TDF
- Research Centres
  - NTIA
  - Toyama University
  - Yonsei University

A FR Model for Multimedia

- BT have developed a suite of perceptual quality solutions (FR, RR, NR)
- FR model part of new standards
- Model tested for
  - codecs (MPEG-2, MPEG-4, H.263, H.264)
  - image sizes (D1 - QCIF)
  - frame rates (30, 25, 15, 10, 5)
  - variable content

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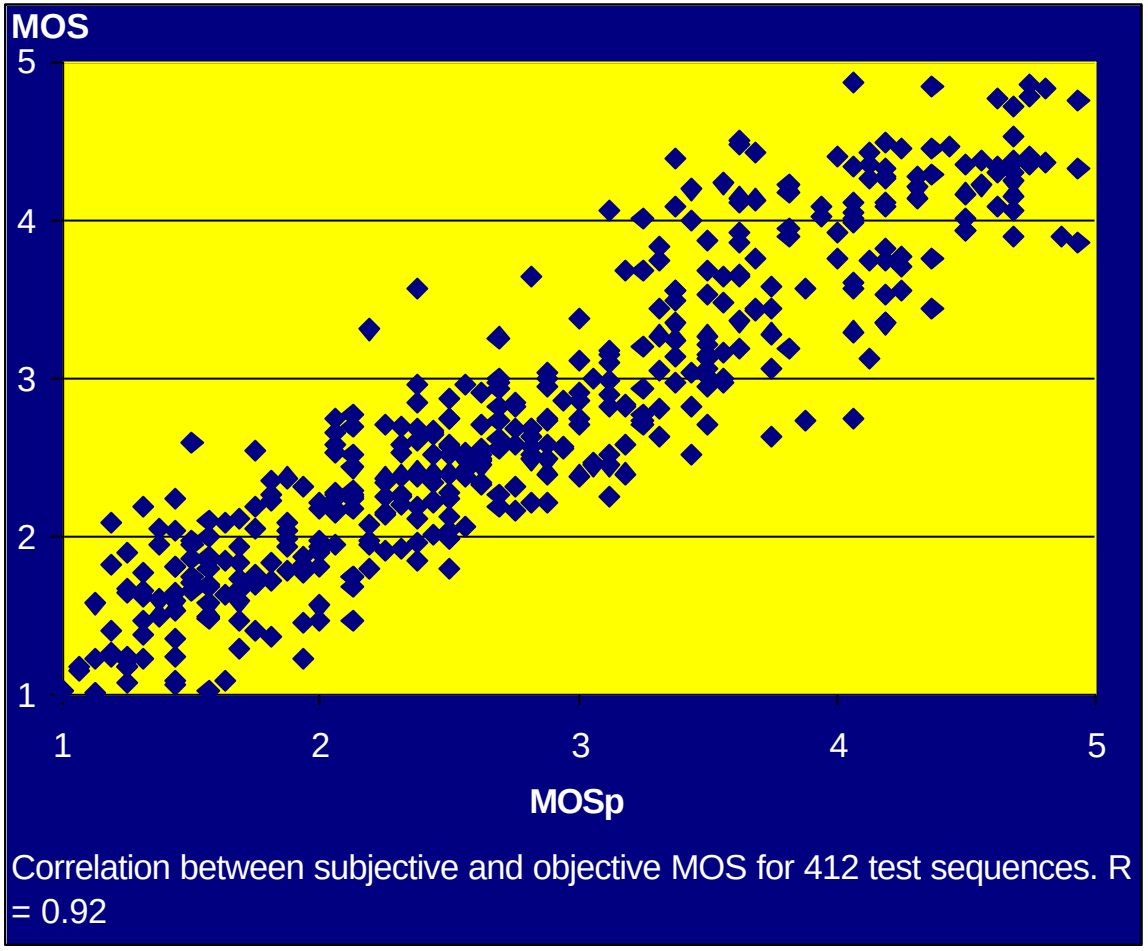
Model Performance



Correlation between subjective and objective MOS for 412 test sequences. R = 0.92

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Model Performance

- Various content
- SIF, QCIF
- 25 - 5 fps
- MPEG-4, H.263
- 320kbit/s - 16kbit/s
- With and without transmission errors

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Demonstration

Link to demo