UNMANAGED ABR:
HOW TO CONTROL THOSE UNRULY TEENAGERS

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Managed Adaptive Streaming (MAS) Taking control from Unruly ABR Clients

Managed ABR Video Service Overview

- – Unmanaged ABR: Potential Issues
- – Previous Findings: DOCSIS QoS, SABR
- – MAS Overview

Lab Results

- – Unmanaged ABR vs. MAS
- – Scaling with Network Capacity: 40 to 80 to 160Mbps
- – Behavior with Severe Overload

Conclusions

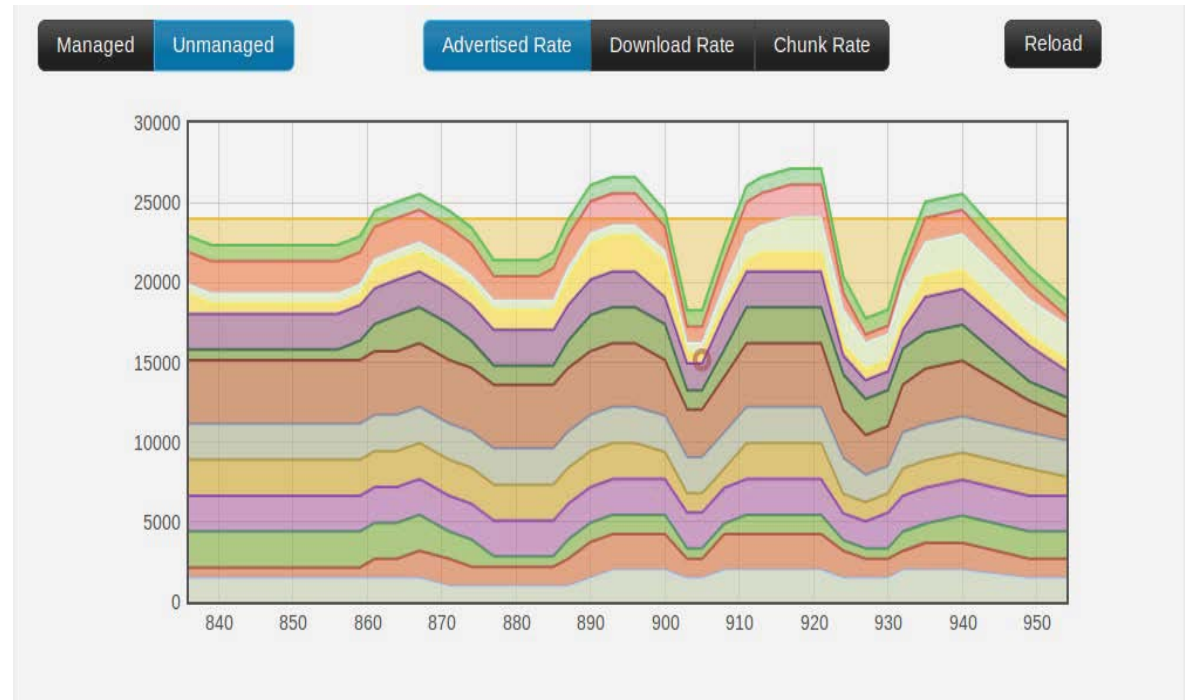# Potential Issues with ABR Delivery

Instability
- QoE Impacts

Unfairness
- Multiple types

Inefficiencies

No Admission Control

Challenge – How do we offer a <u>Managed</u> Video Service to ABR Devices with required <u>QoE</u>?

Unmanaged ABR, DOCSIS QoS Conclusions

Managed IP Video Service must address ABR QoE

– Instability, Unfairness, Inefficiencies, Congestion control

DOCSIS QoS

– Requires a Service Rate that is twice max Chunk Bit Rate

– Provides some benefits but ***does not fix problems***

• Three levels of congestion control: DOCSIS, TCP, ABR

– Potential scaling issues using PCMM

– Not applicable to other network types: wireless, FTTP

Smart ABR (SABR) Conclusions

From "Smart ABR (SABR): The Future of Managed ABR Services", Ulm et al., 2013 Cable Show Technical Forum

SABR centralizes Chunk Bit Rate selections in the cloud
– Provides Stability, Fairness, Improved Channel Utilization
– Graceful degradation during congestion

Intelligent Bit Rate selection
– Improved QoE
– Potentially 30-50% Stat Mux gains

SABR – provides operators with increased video capacity while maintaining consistent QoE across all clients

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Managed Adaptive Streaming (MAS)

Cloud Based control of Adaptive Streaming protocols

- Fairly spread available bandwidth across ALL clients
- Video Quality per segment per client
- Support for standard ABR clients, no changes!!

Ideal Managed ABR Solution should leverage:

- Network topology including available bandwidth
- Session Information
  - Subscriber service levels (SLA), device type, screen size
- Content Information
  - Format (e.g. SD/HD), Video Quality (VQ) information

MAS Test Methodology

Content:
Bit Rate & Resolution

Bit Rate (Kbps)	Resolution
360	512x288
1000	640x360
1500	768x432
2800	1280x720

Video Quality Metrics

VQ Range	Quality	Impairment
85-100	Excellent	Imperceptible
70-85	Good	Perceptible, not annoying
55-70	Fair	Slightly annoying
40-55	Poor	Annoying
0-40	Bad	Very annoying
Video Freeze	Terrible	Unacceptable

Expectation: 90+% Good/Excellent; >1% Poor, 0% Bad

Device Distribution

Device	Percentage	Max Bit Rate
HDTV	50%	2800 Kbps
Tablet	40%	2800 Kbps
Hand-held	10%	1000 Kbps

Client distribution: 18 to 160

Channel BW: 40, 80, 160Mbps

Unmanaged ABR & MAS tests

Baseline Reference – Unmanaged ABR
40Mbps, 18 clients

Reference - 40 Mbps / 18 clients - Video Quality

Video Quality - Percentage of viewed time

Playback Buffer Fullness - Reference 40Mbps / 18 clients

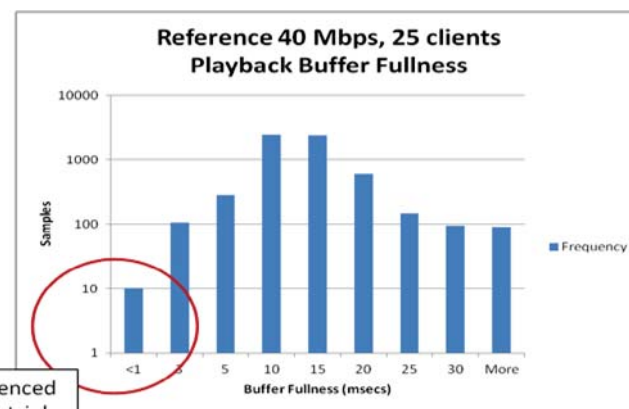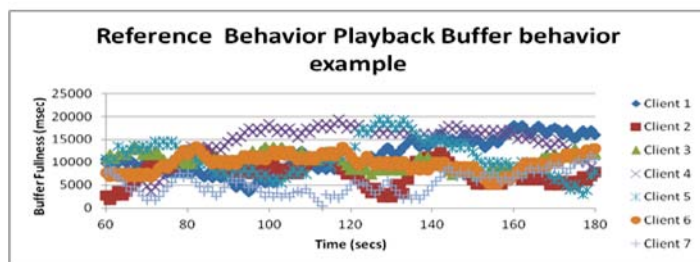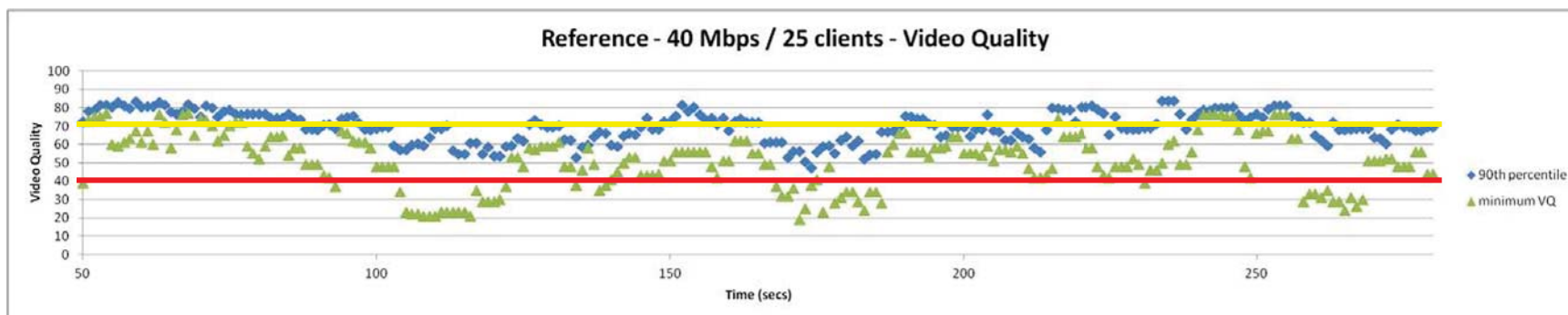% of clients / Lowest Buffer - Reference 40Mbps / 18 clients
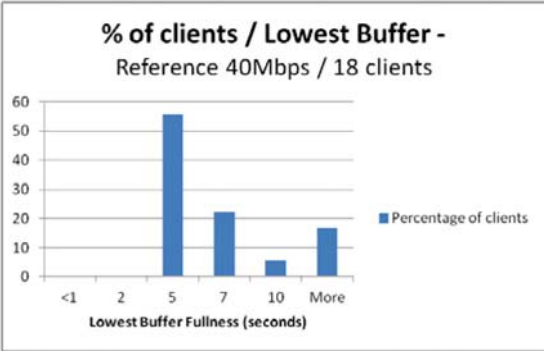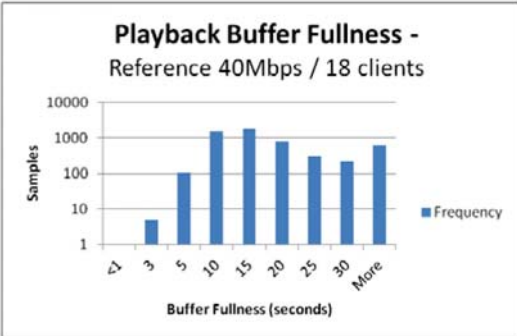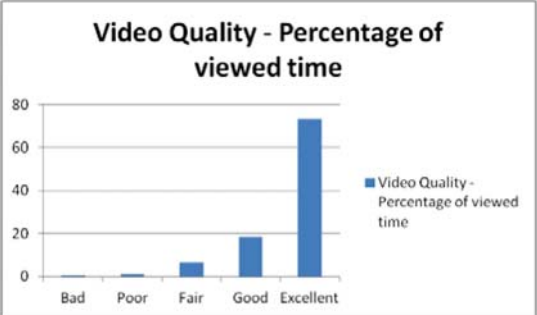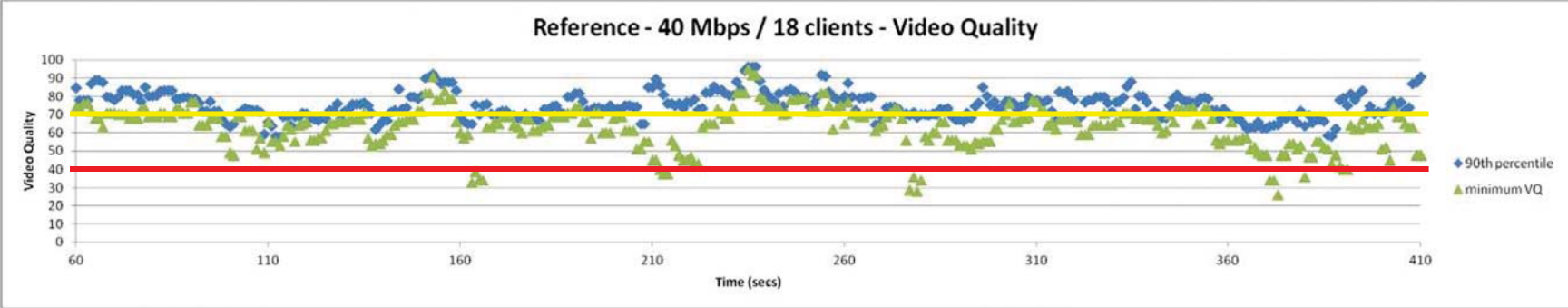
90th Percentile falls below Good;1.3% Poor, 0.3% Bad; No Video Freezes

Overall QoE: acceptable for OTT, *marginal* for Managed Video Service
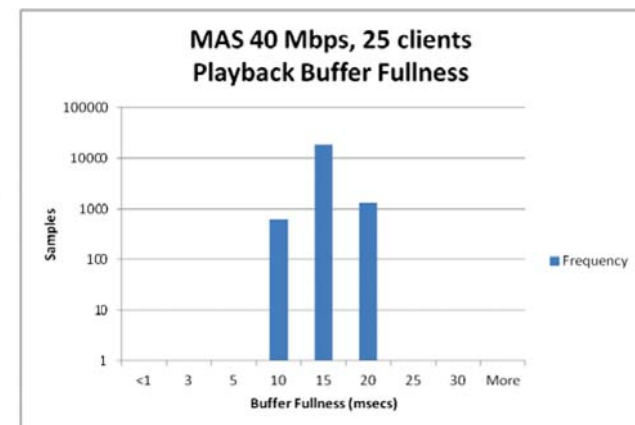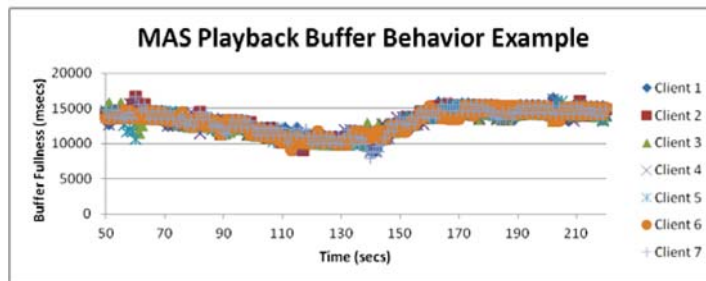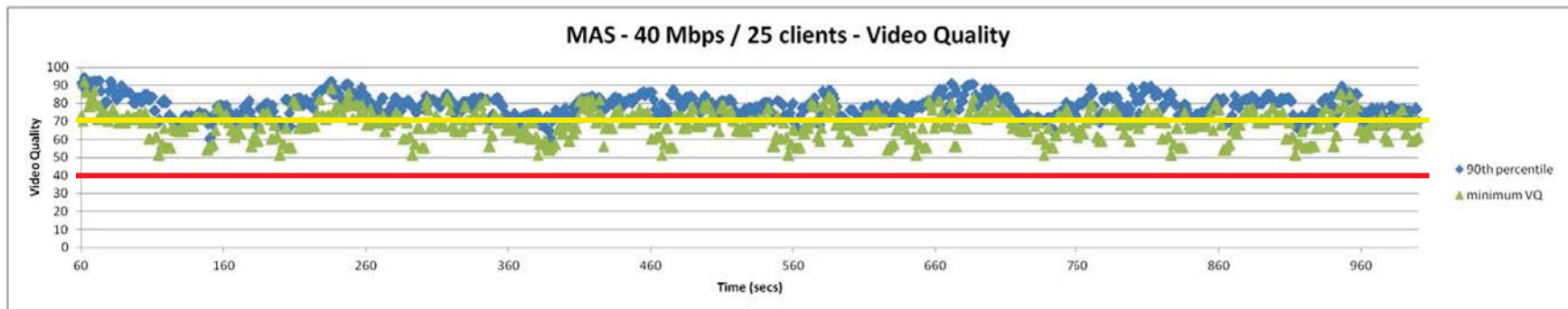
Unmanaged ABR – 40Mbps, 25 clients

90th Percentile falls below Good; 3% Poor, 1.1% Bad; 28% had Video Freezes

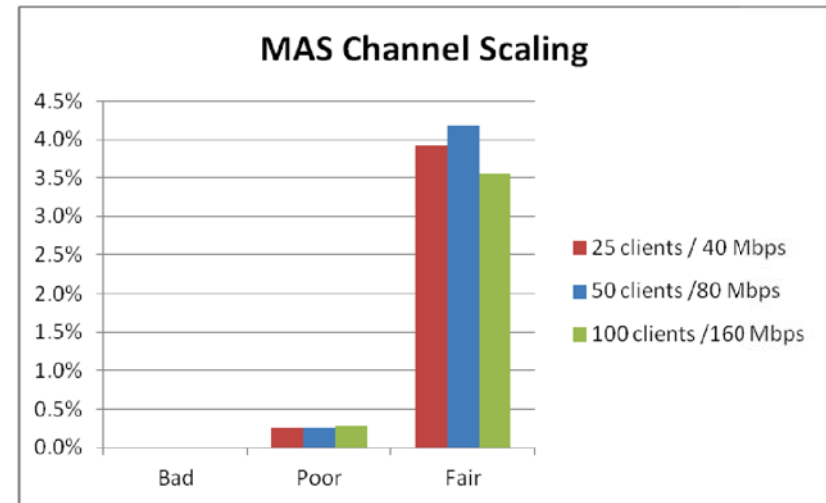**Overall QoE: _Unacceptable_!!**

MAS – 40Mbps, 25 clients

MAS - 40 Mbps / 25 clients - Video Quality

MAS Playback Buffer Behavior Example

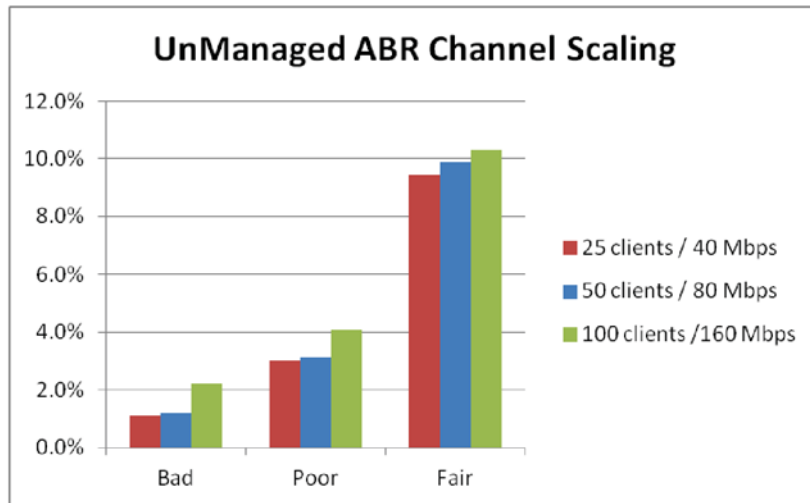MAS 40 Mbps, 25 clients Playback Buffer Fullness

90th Percentile stays above Fair; 0.3% Poor, 0% Bad; No Video Freezes

Overall QoE: _Good-to-Excellent_!!
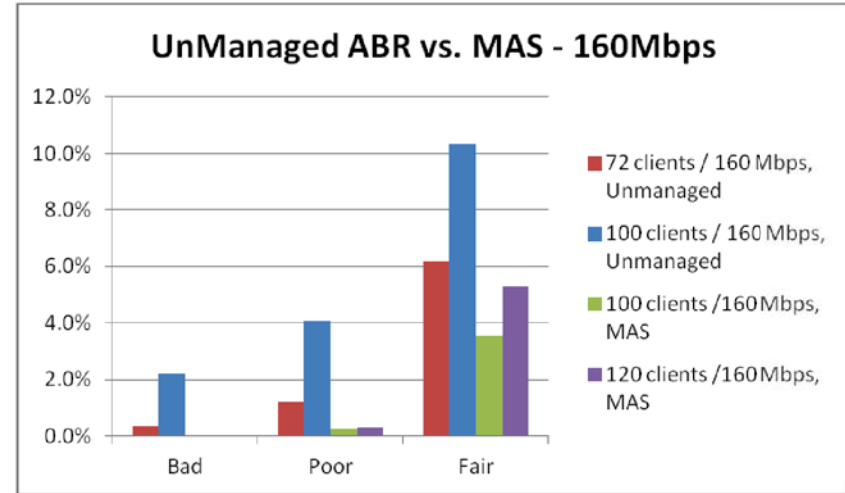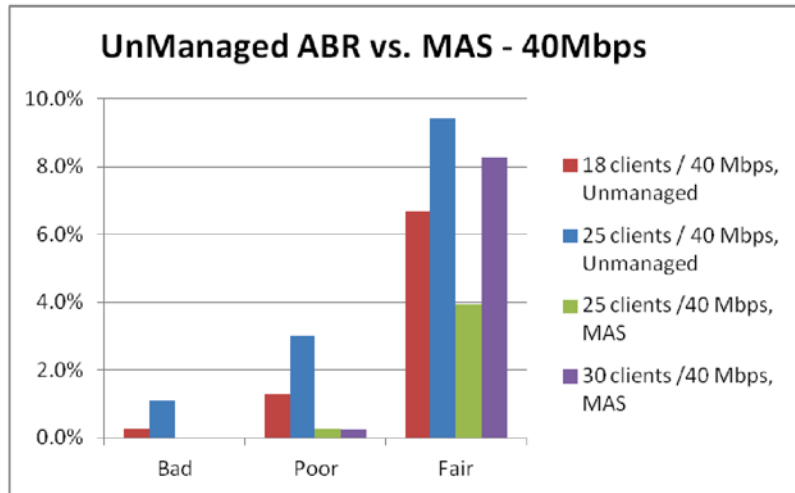
PSNR

Scaling with Network Capacity
40Mbps, 80Mbps, 160Mbps

- Unmanaged ABR: worse with increased capacity
  - Video freezes jumps from 28% to 38% to 64% of all clients
- MAS remains stable with slight gains, scales linearly
 - Seems that most stat mux gains comes before 25 clients

Unmanaged ABR vs. MAS 40Mbps, 160Mbps

UnManaged ABR vs. MAS - 40Mbps

- 18 clients / 40 Mbps, Unmanaged
- 25 clients / 40 Mbps, Unmanaged
- 25 clients / 40 Mbps, MAS
- 30 clients / 40 Mbps, MAS

UnManaged ABR vs. MAS - 160Mbps

- 72 clients / 160 Mbps, Unmanaged
- 100 clients / 160 Mbps, Unmanaged
- 100 clients / 160 Mbps, MAS
- 120 clients / 160 Mbps, MAS

- ▶ 40Mbps: MAS @ 30 better than Unmanaged @18
  - – Even MAS @ 40 was better behaved
- ▶ 160Mbps: MAS @ 120 better than Unmanaged@72
  - – MAS @ 120 clients also shows reduced Fair segments

MAS Behavior under severe Overload 160 clients @ 160Mbps

MAS Client Scaling

Legend:
- 100 clients /160 Mbps
- 120 clients / 160 Mbps
- 160 clients / 160 Mbps

Categories: Bad, Poor, Fair
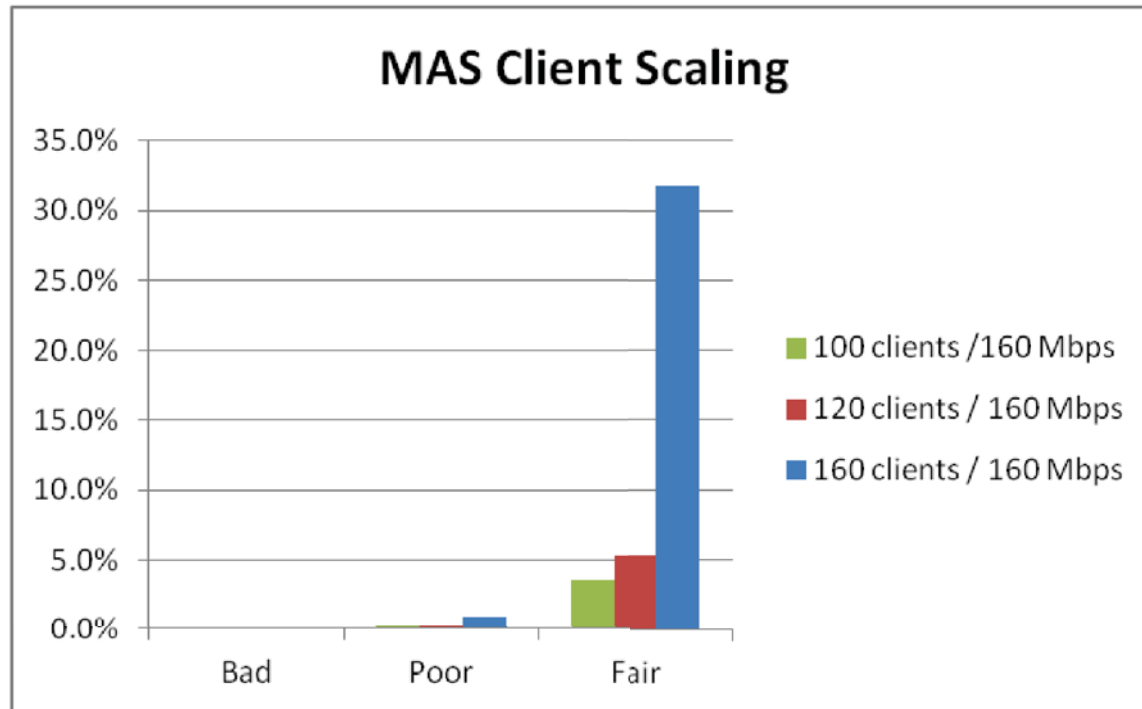
▶ **MAS remains very stable under severe overload**
- No Video freezes; No Bad; >1% Poor
- Bandwidth shared fairly among clients, 67% Good/Excellent

Conclusion: MAS takes Control of Unruly 'Teenage' ABR Clients

- **Unmanaged ABR has significant QoE issues**
  - MAS tests confirms SABR results – video freezes, instability, poor QoE
  - DOCSIS QoS, Bigger capacity pipes are not the answer

- **Cloud based MAS solves QoE issues**
  - Provides fairness across clients; constant QoE across content
  - Almost 2:1 throughput improvement over unmanaged ABR
  - Stable buffers bodes well for live content
  - Scales well with network capacity
  - Easily handles severe overload condition; no admission control needed

> *Managed ABR Video Service QoE Requires Cloud based MAS*

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