

EXPERIENCE

True HD Quality

The MPEG-2 / H.264 Paradigm

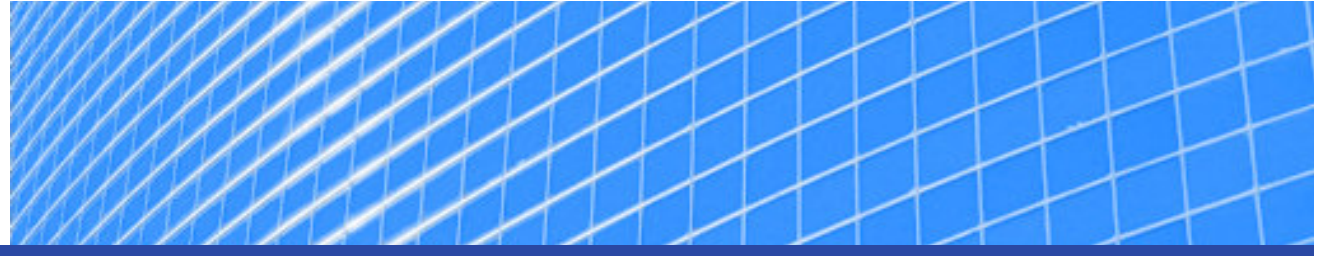
TELECOM@NAB2007

April 17th, 2007

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Agenda

- Where does HD come from?
- The HD delivery chain
- Operators' challenges
- What is true HD quality?
- Solutions
- A word on 1080P
- Conclusion



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Where do HD pictures
come from?

From HD cameras...

Or do they?...

HD Content Delivery Chain

- All HD sources are not created equal
- Different types of content and formats

- Full resolution sports ☺
- Up-converted SD film ☹
- Format conversion (1080i <> 720p)

- Different sources

- Nationals: ESPN, HBO, Starz, Discovery, ...
- Locals: Fox, ABC, NBC, CBS, CW
- On-demand: PPV, VOD servers

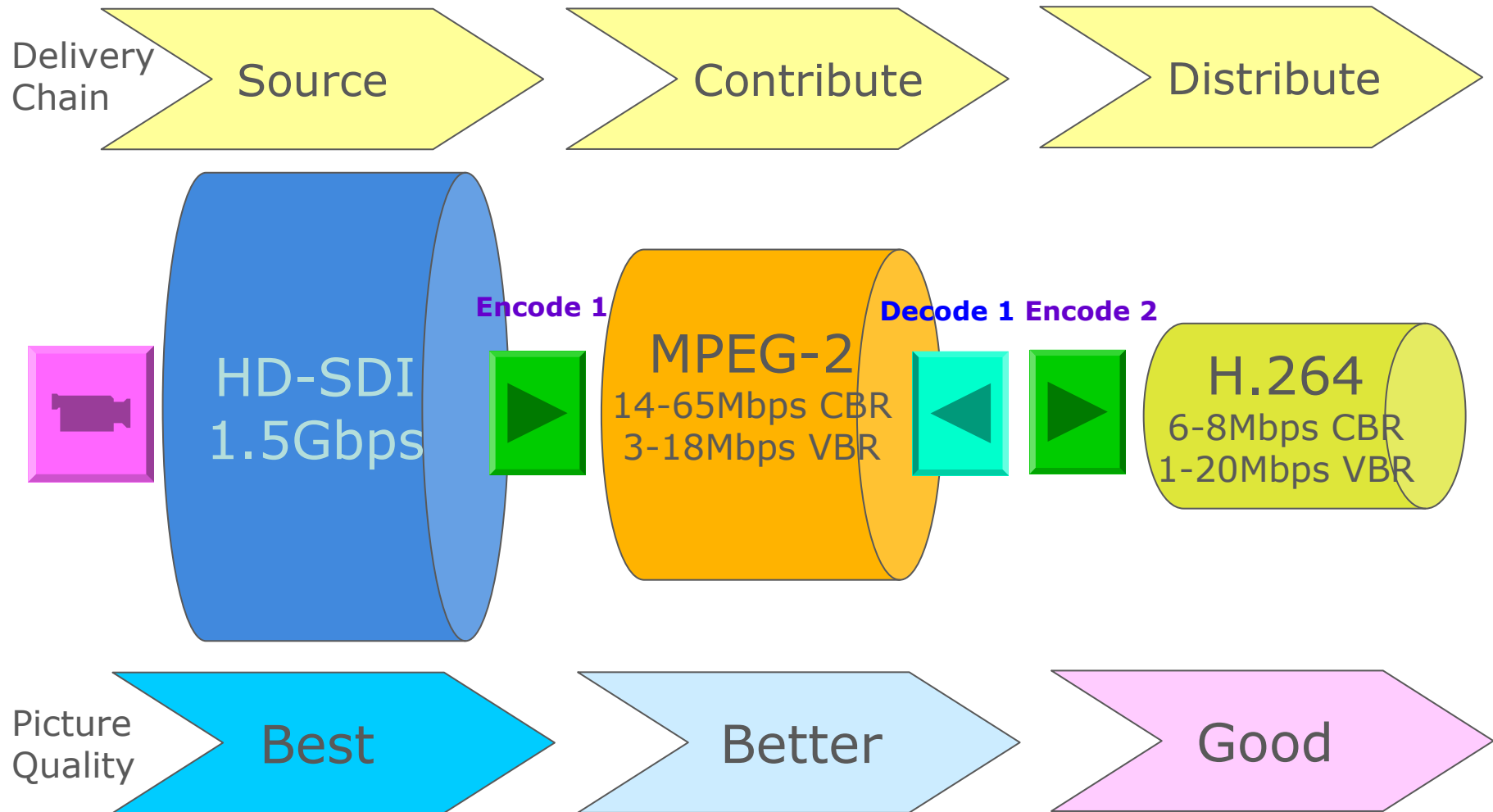
- Different contribution pipes

- Wired: fiber, IP or ATM up to 1Gbps, best quality
- Wireless
 - Satellite link: limited by transponder space ~35Mbps: acceptable quality
 - Off-air ATSC: 19.4Mbps, HD + SD statmux: poor quality if legacy encoders

"60% of the 25 million U.S. households that own an HDTV set do not receive HD programming from terrestrial broadcasters, cable, satellite, IPTV or other sources"

Mike Paxton, In-Stat (Jan 2007)

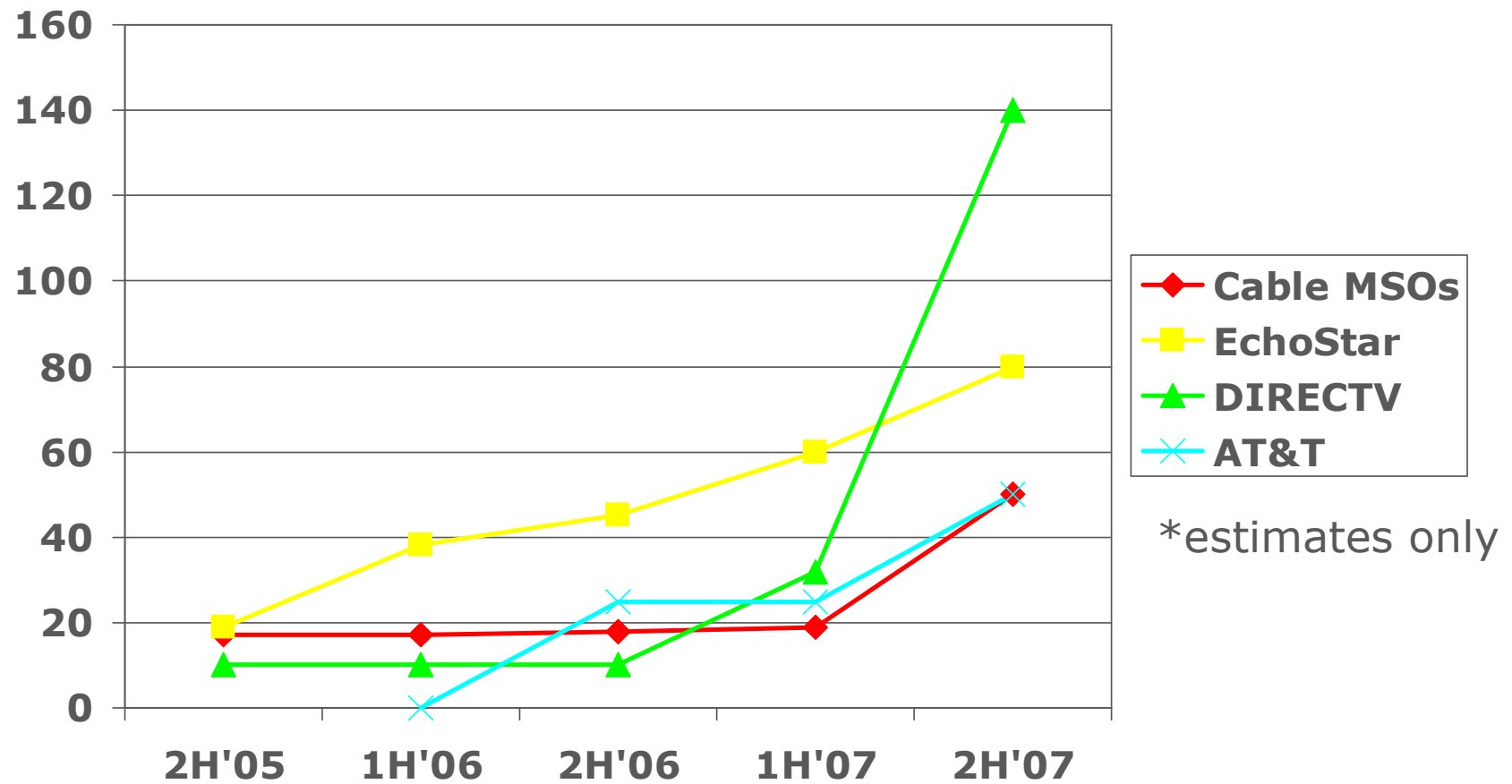
The Great Bandwidth Squeeze



HD Operators' Challenges

	Cable	Satellite	Telco
Distribution type	CHE and RHE (rate shaped) National uplinks: HD re-encoding	CHE with LAN (backhaul) and WAN (remote statmux)	SHE (nationals) and VHO's (add locals)
Access	Broadcast	Broadcast	Multicast
Dist. format	MPEG-2 VBR	AVC VBR	AVC CBR or C-VBR
Access BW	38.8Mbps 3 or 4 ch per QAM	37-45Mbps 5 to 7 ch per TxP	20Mbps ADSL2+ 1 or 2 ch + HSI
1080i Resolution	1920 or 1440	1440	1440, 1280, 960
Avg bitrate	12.1Mbps VBR	6.1Mbps VBR	8Mbps Capped
Quality of nationals	Excellent	Good	Fair
Quality of locals	Poor	Poor	Poor

US National HD Capacity*




What is “True” HD Quality?



Happier Subscribers 😊

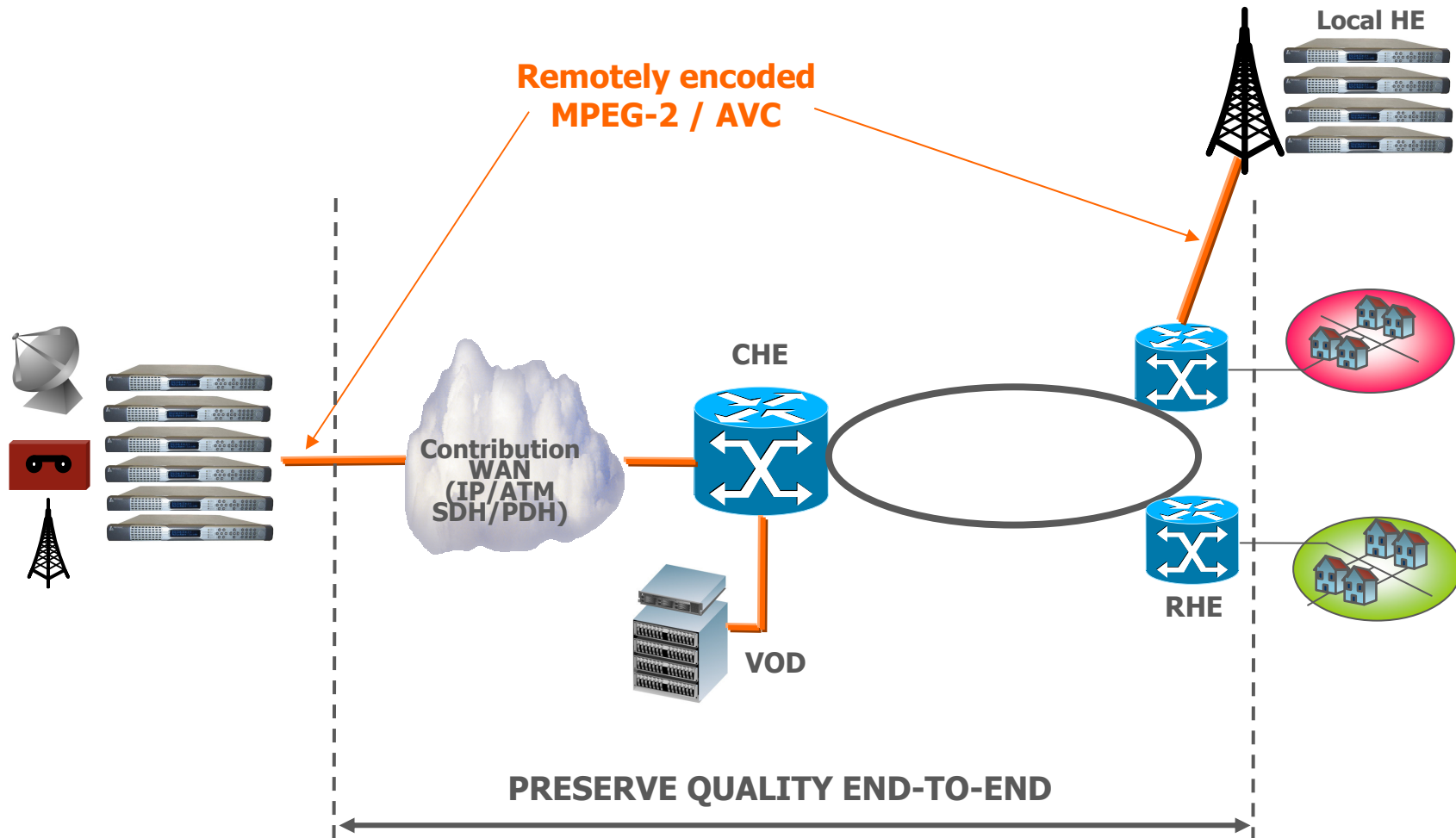
- Maintain or increase ARPU
- Higher take rate, lower churn rate

- Full resolution: 1080i x 1920
 - Better picture depth and sharpness, even on Plasmas / LCDs of 1080 x 1365 pixels
 - Goodbye “HD Lite”
- Artifacts
 - Local broadcast sources encoded with 7 year old HD encoders look like c...
 - Macroblocks or noise
 - Overuse of filters softens the picture, “washout” effect
- 1080P  **HD DVD**
 - Sets the quality reference
 - “Crystal Clear” pictures

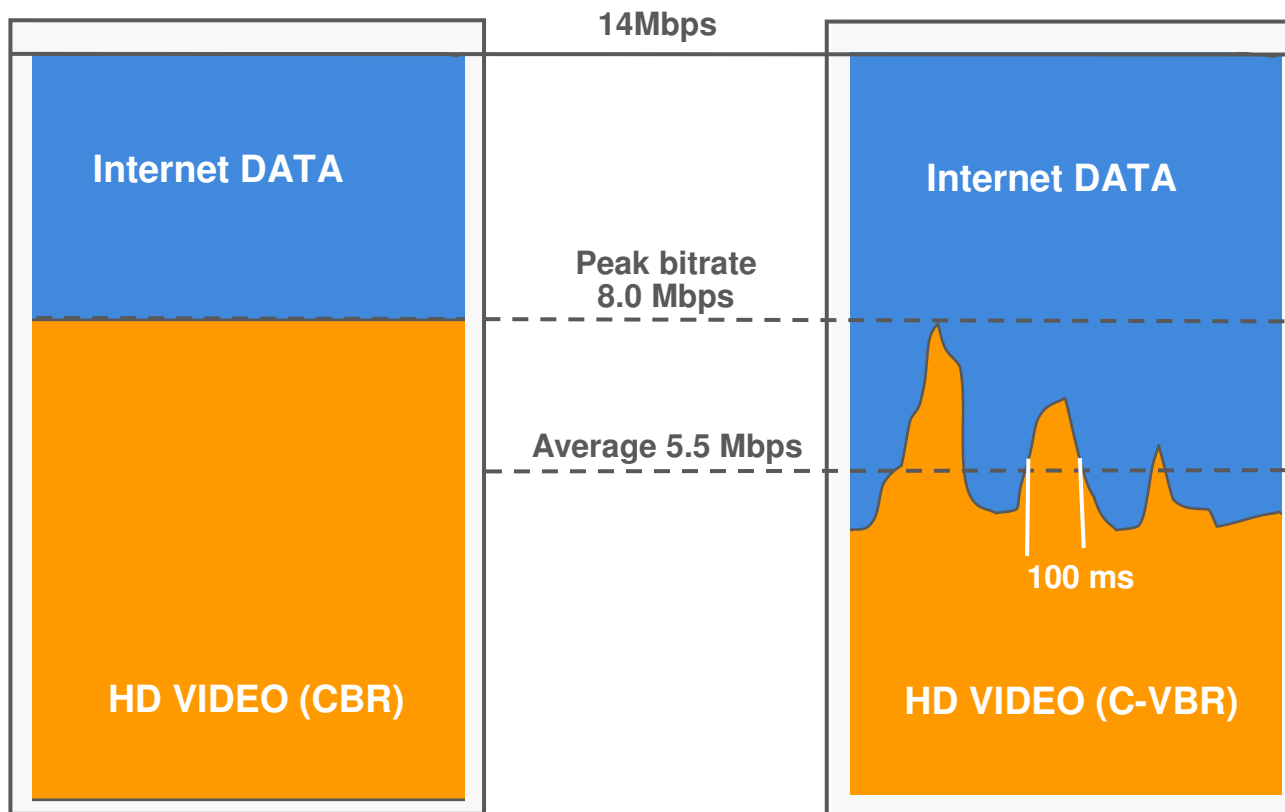
Room for Improvement

- No magic formula, but here's what the doctor prescribes:
- Treat the problem WHERE it occurs
 - Great encoders at the end of the chain are not enough
 - REMOVE unnecessary decode/encode stages
 - Move the encoders at the origination point: REMOTE STATMUX DEPLOYED
 - Widen aggregation pipe: JPEG 2000 at 270Mbps
 - If not possible, contribute in MPEG-4 AVC instead of MPEG-2
- Course of action
 - Use full resolution with best of breed MPEG-2 / AVC encoders
 - Cable: decode / re-encode instead of rate shape
 - Reclaim bandwidth and increase HD quality
 - Satellite: remote statmux over IP with FEC
 - IPTV: remote encoders over IP (FEC) with Capped VBR
 - Closed loop statmux on aggregation network (ATM)
 - Differentiate user experience (PIP, fast channel change, nPVR, VOD,...)

Eliminate Compression Bottlenecks



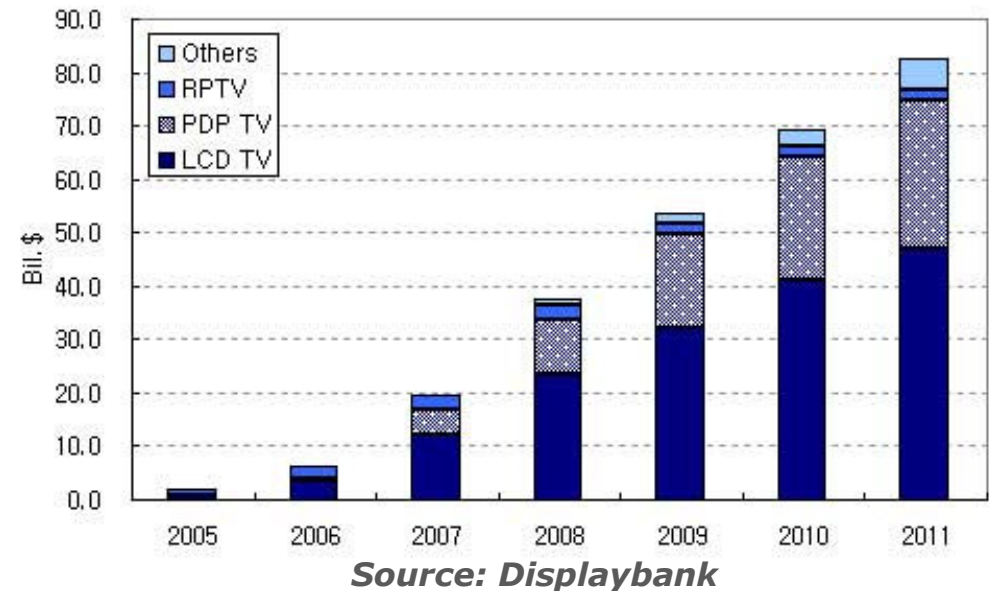
Precious Tool for IPTV: Capped VBR



- Reclaim HSI bandwidth without degrading Video Quality

What About 1080p?

- Consumers demand it
- 1080p TV market to explode
 - 7 million sets this year
 - 70 million by 2011
- Two flavors: 1080p@24/30 and 1080p@60
- 1080p 24 fps ("1080PsF")
 - 1.5Gbps HD-SDI
 - HD AVC STBs capable
 - Production format for movies
 - Can be introduced as premium PPV or VOD service
 - No extra bandwidth required



- 1080p 60 fps ("true 1080p")
 - Requires 3Gbps infrastructure
 - Requires new STBs
 - Future format for sports
 - Can up-convert from 1080i or 720p
 - More bandwidth required!

Conclusion

- Compromises are being made
 - Production: up-conversion, format conversion
 - Contribution: some degradation
 - Distribution: local decode/encode
 - Display: scaling and sampling artifacts
- Consumers more demanding
 - 1080P IS the new benchmark
- HD is a PREMIUM service!
 - Quality is key to HD success and mass adoption
 - Solutions exist for ALL operators
 - Give your subscribers what they want



It's like seeing Television
for the first time.

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