



ULTRA HIGH DEF **REVOLUTION**

.....
A TECHNOLOGY PRIMER

Agenda

5-10 minutes
each



Phil Lelyveld – Overview
Dave Stump – DP, Camera
Phil Squyres - Workflow
Brad Lipson – DP, The Wedding Ringer
Greg Gardiner – DP, Rake (11 episodes)
Q&A

Samsung **UHD**TV S9
Ultra High Definition

Organized by
Brian Zink.
Thanks!

Demo Area

Blackmagicdesign

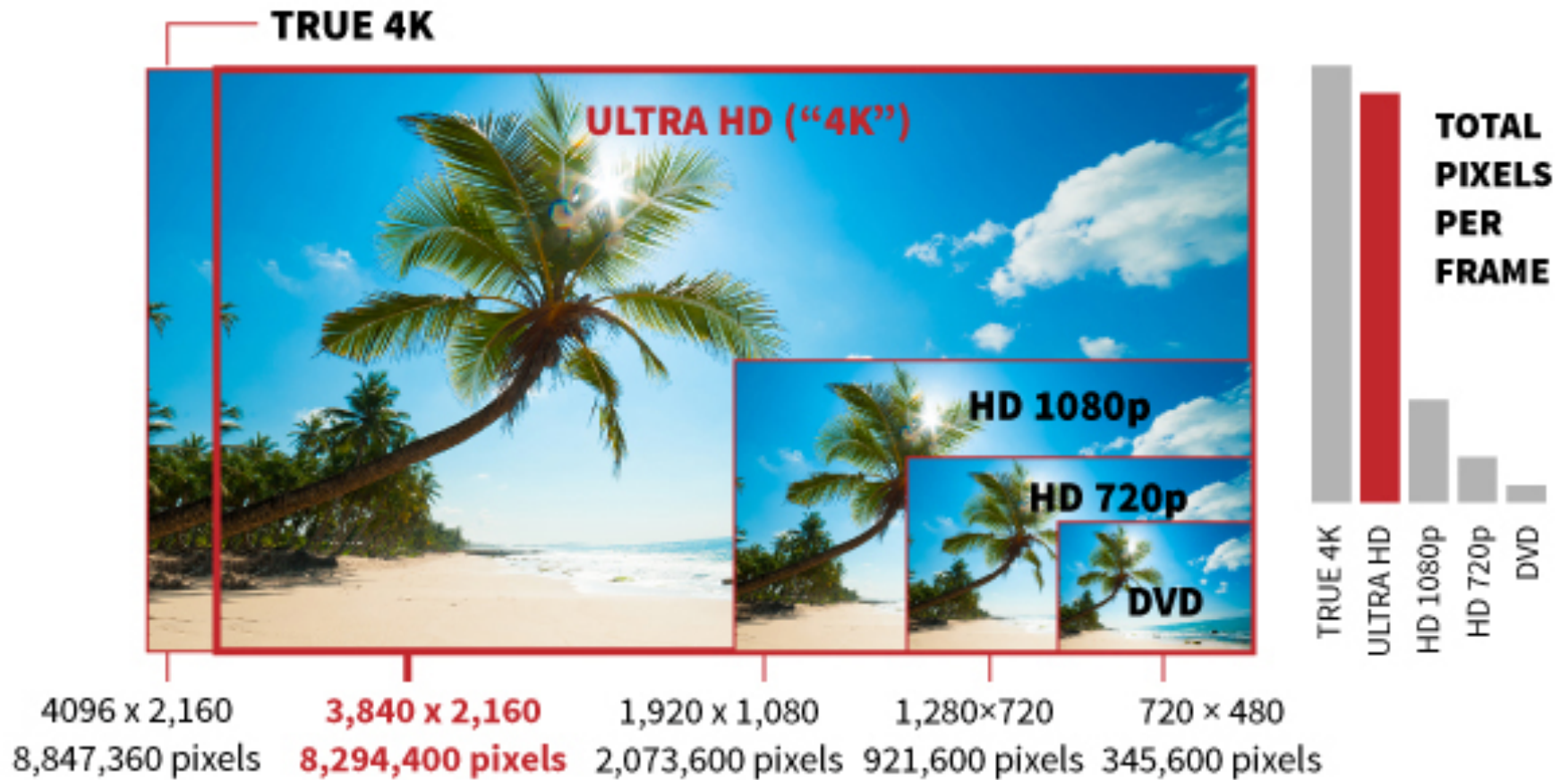


Ultra HD Primer & Overview of the Current Situation



Philip Lelyveld
USC Entertainment Technology Center
6/24/14

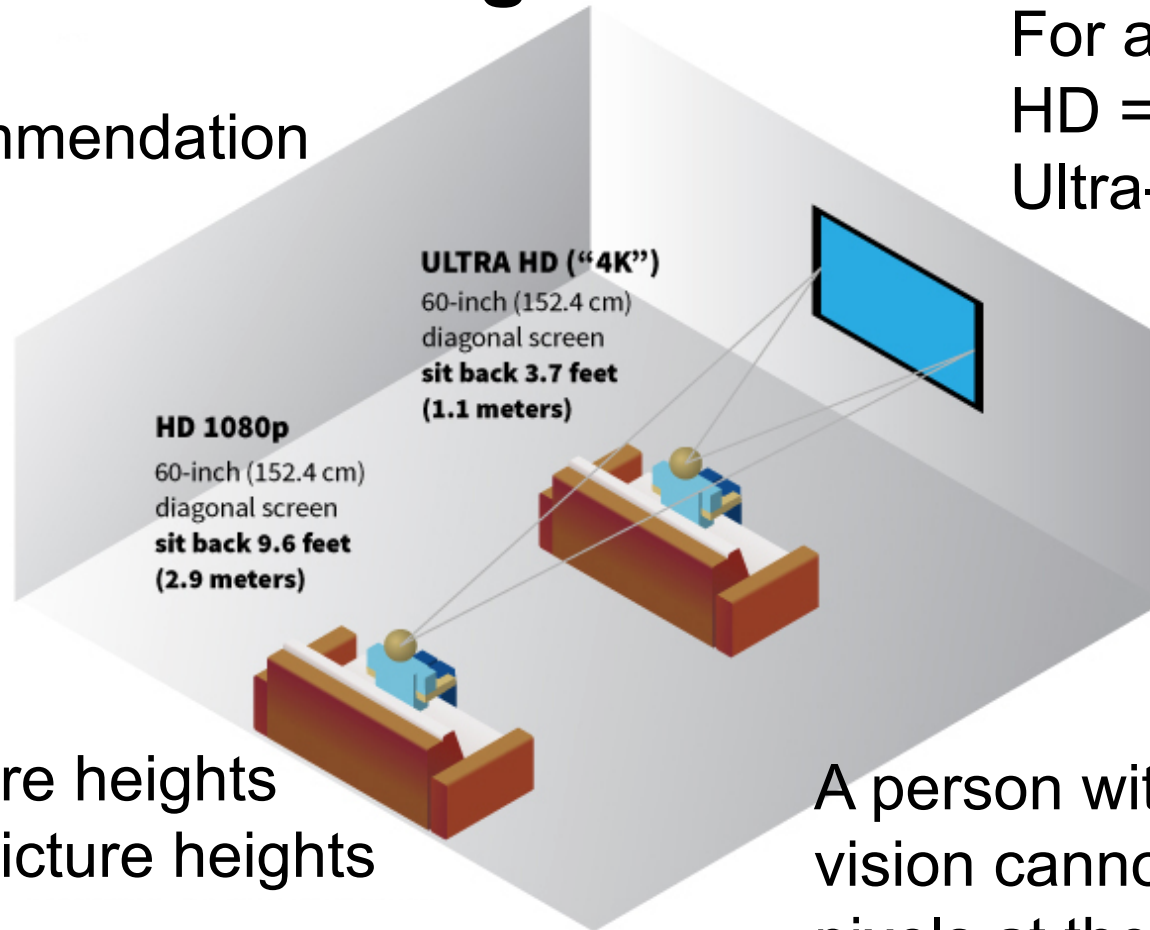
What is Ultra HD



Source: What Is 4K TV?, MARCH 10, 2014, www.tomsguide.com

Viewing distances

ITU recommendation



For a 60" screen
HD = 9.6'
Ultra-HD = 3.7'

HD – 3 picture heights
UHD – 1.5 picture heights

A person with normal
vision cannot discern the
pixels at these distances

Source: What Is 4K TV?, MARCH 10, 2014, www.tomsguide.com

Is Higher Resolution Enough?

For consumers?

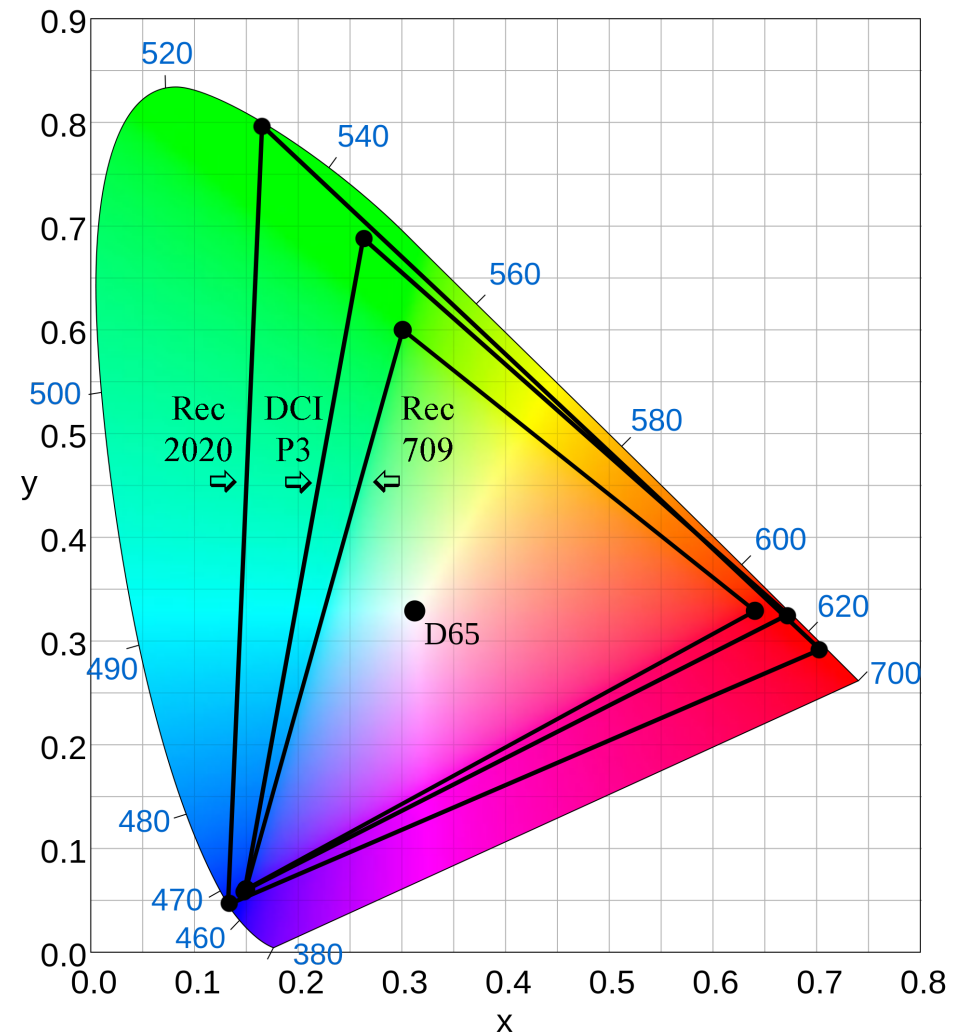
For production workflow?

Ultra HD “Plus”

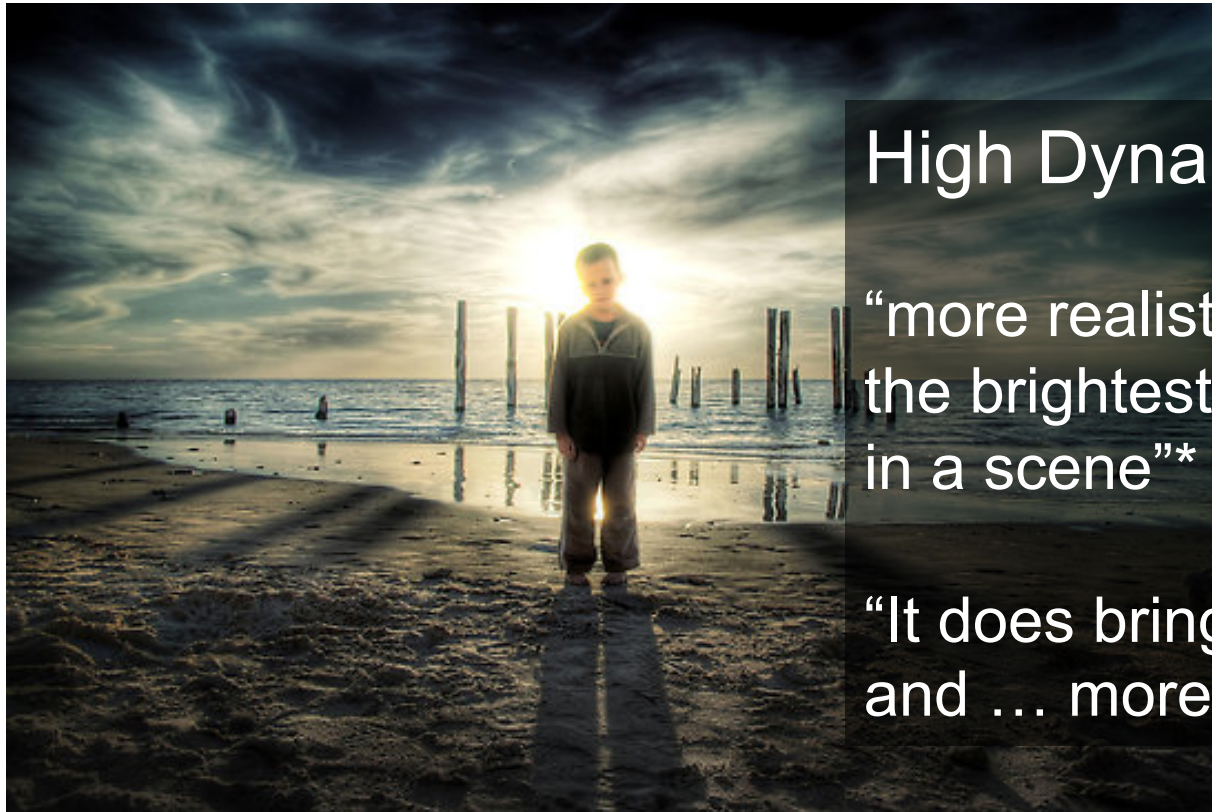
Wider color gamut

“the subset of colors which can be accurately represented in a given circumstance”*

* Gamut page in Wikipedia
Diagram by Dave Stump



Ultra HD “Plus”



High Dynamic Range

“more realistic perception between the brightest and darkest elements in a scene”*

“It does bring sparkle to the image, and ... more detail in dark areas.”**

* Beyond HD: Update, EBU webinar by Dr. Hans Hoffman

** David Wood, ITU WG Chairman, April 29, 2014, www.etcentric.org

Ultra HD “Plus”

Higher Frame Rate

120p Frames per Second
ITU-R BT.2020 recommend

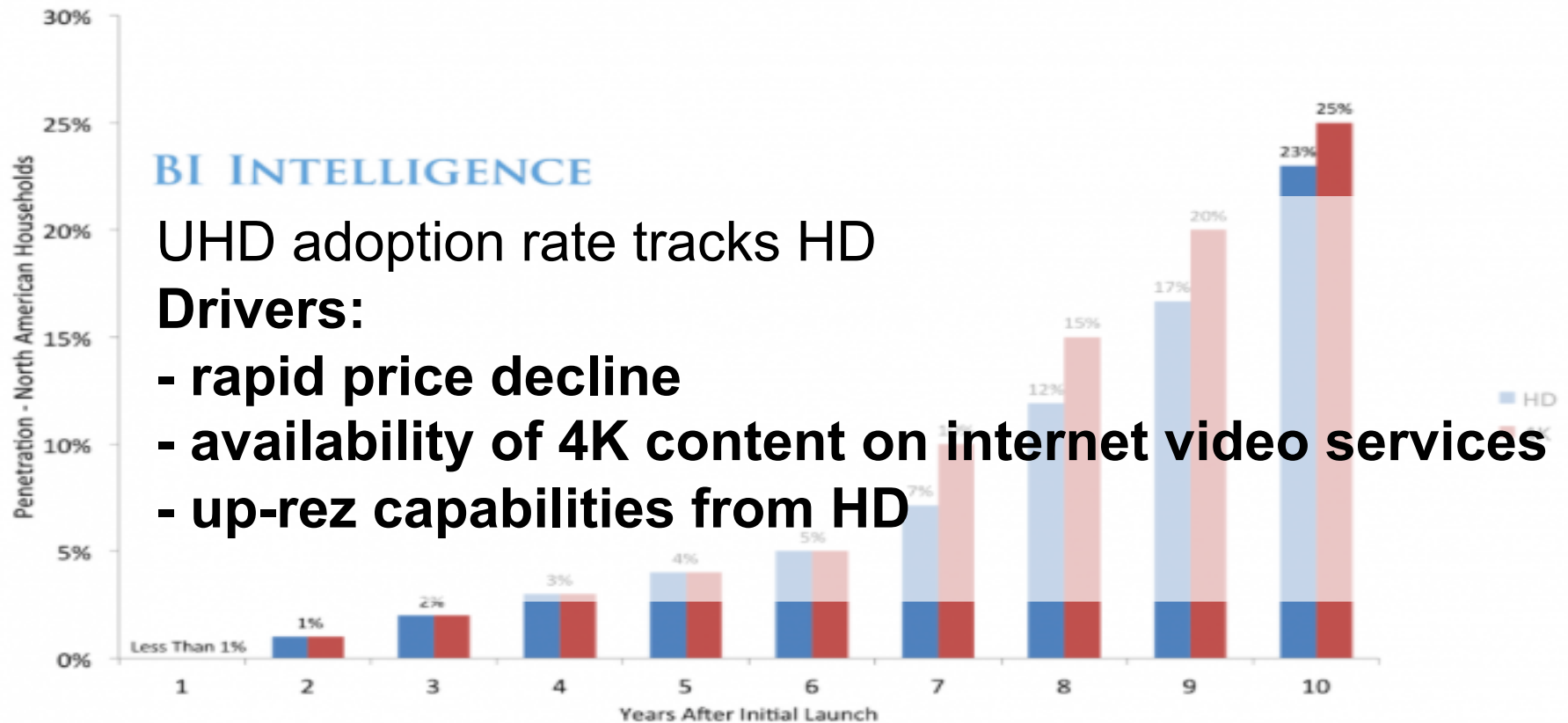
Better 3D TV experience*

1. Ultra HD - Spatial resolution
2. Wider color gamut
3. Higher dynamic range
4. Frame rate – Temporal resolution (>120p)
- 5. Bit-depth - 10, 12, 16, and full range coding**
- 6. Aspect Ratio**

* Beyond HD: Update, EBU webinar by Dr. Hans Hoffman

Consumer and Market Data

HD Vs. 4K Adoption In North America



Notes: HD year 1 is 1998, 4K year 1 is 2012, 4K penetration rates are forecasted after year 2
Source: Leichtman Research Group, BII Forecast

Ultra HD Rapid Price Decline

Prices of 4K TVs fell 85% worldwide in just 2 years*

- Name brands command a 50% premium
- Low-cost Chinese sets dominate global sales

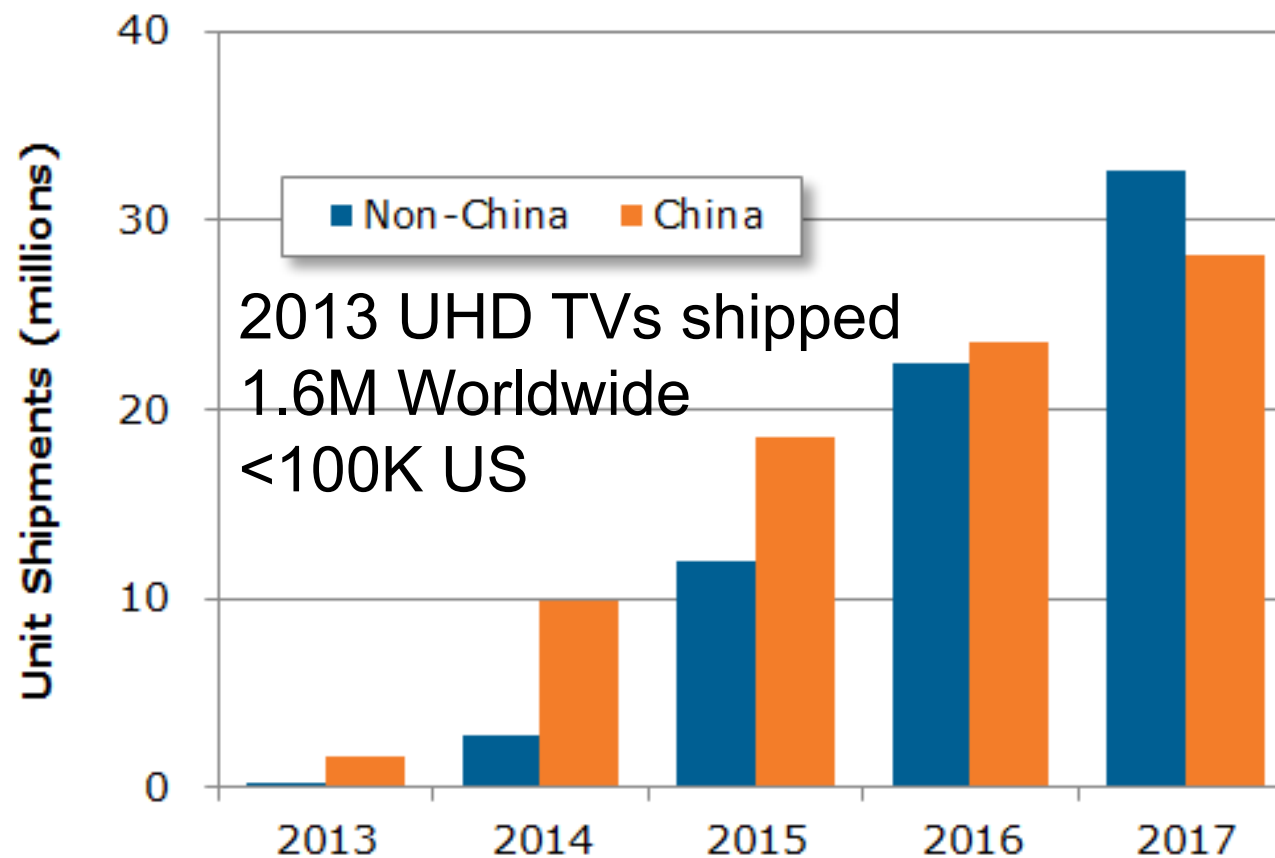
China domestic UHD TV sales account for...

- 87% of worldwide sales of UHD TVs in 2013**
- 78% of worldwide sales of UHD TVs in 2014**

*The Rise Of 4K TV, Business Insider, April 10, 2014

** NPD Group's DisplaySearch data quoted in Who's leading the pack in 4K TV sales? China, Fortune, March 5, 2014

4K x 2K LCD and OLED TV Forecast



Source: 4K UHD TV Shipments to Rise Dramatically in China Next Year – Analysts, Dec. 30, 2013, Xbit Labs

Ultra HD Rapid Price Decline

Chinese Manufacturers **entering US/global market**

Sony 49" \$2,200

Samsung 48" \$2,500

TCL 50" \$800 on Amazon

Seiki 50" \$770 plus \$49 HDMI with up-rez chip

Worldwide average screen size - 39.6"

Demand for 32" is lower than demand for 60"

Two key general-purpose technical advances*

HEVC (High Efficiency Video Coding) compression

Also called H.265 (~twice as efficient as H.264)

New UHD sets from Sony, Samsung, LG support it

VP9 from Google is a possible competing compression

HDMI 2.0 (High Definition Multimedia Interface standard)

Carries uncompressed signal to UHD TV

Increases bandwidth up to 18Gbps

Supports Ultra HD at 50/60 fps, 12-bit 4:2:2 color

Works with current high-speed HDMI cable



* Ultra HD and 4K TV: Everything you need to know, April 10, 2014, www.TechRadar.com

- HDCP 2.2 – 3rd key tech? Secure flow between devices.

Content for UHD Displays

Content for UHD Displays

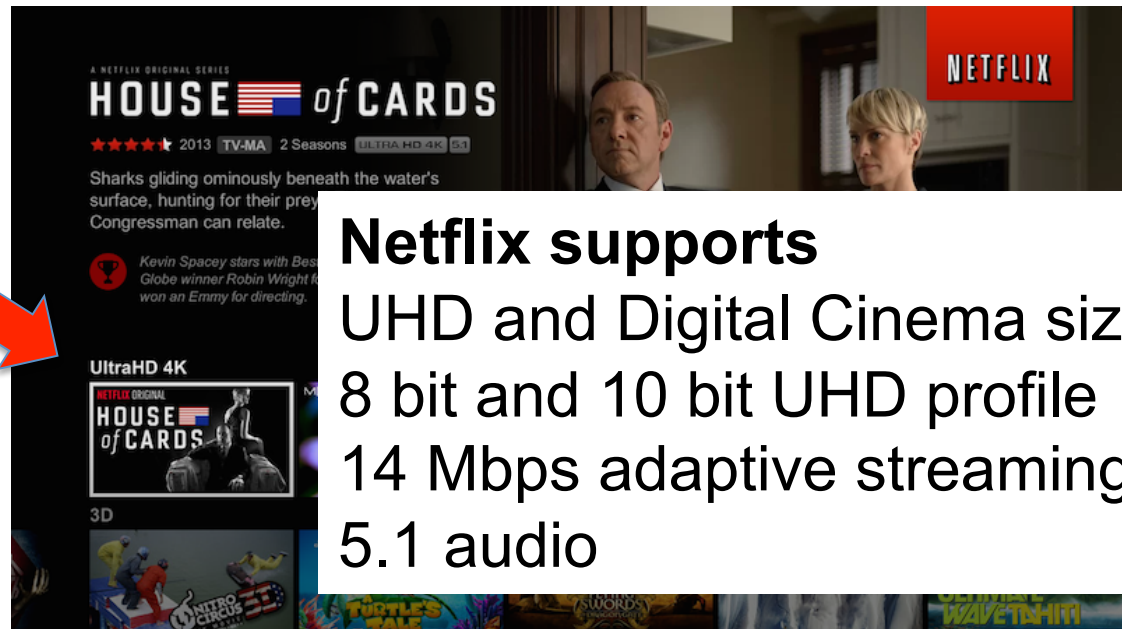
Web delivery

Netflix's House of Cards *"now streaming in UltraHD 4K"**

Amazon, M-GO, other streaming services coming

UltraHD 4K

Breaking Bad



Netflix supports

UHD and Digital Cinema sizes

8 bit and 10 bit UHD profile

14 Mbps adaptive streaming

5.1 audio

* Netflix Now Streaming in Ultra HD 4K,
May 2, 2014, <http://blog.netflix.com>

Content for UHD Displays

Storage Devices

Sony 4K Ultra HD Media Player (\$499)



Ultra-HD Disc

UHD-capable Blu-ray disc expected by end of 2014

Likely 100 GB storage capacity (vs. 50 GB HD Blu-ray)

Content for UHD Displays

Broadcast, Cable, Satellite

Sky UK trial broadcast of English Premier League, Aug, 2013

BBC and Sony trial broadcast of Wimbledon 2013

BBC World Cup trial

Japan started UHD broadcasts on June 2, 2014*

Channel 4K will operate 6 hrs a day

Gov't goal, commercial UHD broadcasting in 2016

Technicolor Ultra HD STB** for cable and sat services

Supports high frame rate, high dynamic range, 10 bit content

* Japan Starts First Ultra High-definition Trial Broadcast, June 2, 2014, <http://www.cdrinfo.com>

** Technicolor Ultra HD Set-top Box Supports High Frame Rate, May 1, 2014, www.etcentric.org



Content for UHD Displays

Up-rez from HDTV

All UHD-TVs have up-rez chips

Quality varies (low cost Chinese sets)

Seiki sells a high-end up-rez chip in the HDMI cable (\$49)

Capturing in 4K produces a better image

HD, up-rez'd HD, and native UHD

Sony is selling “Mastered in 4K” Blu-ray discs

Filmed and scanned in 4K, then down-rez'd to 2K for Blu-ray



Take-Aways



Maybe more colors, dynamic range, frame rate

Consumer adoption looks like HDTV

China – major market, and Chinese brands going global

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