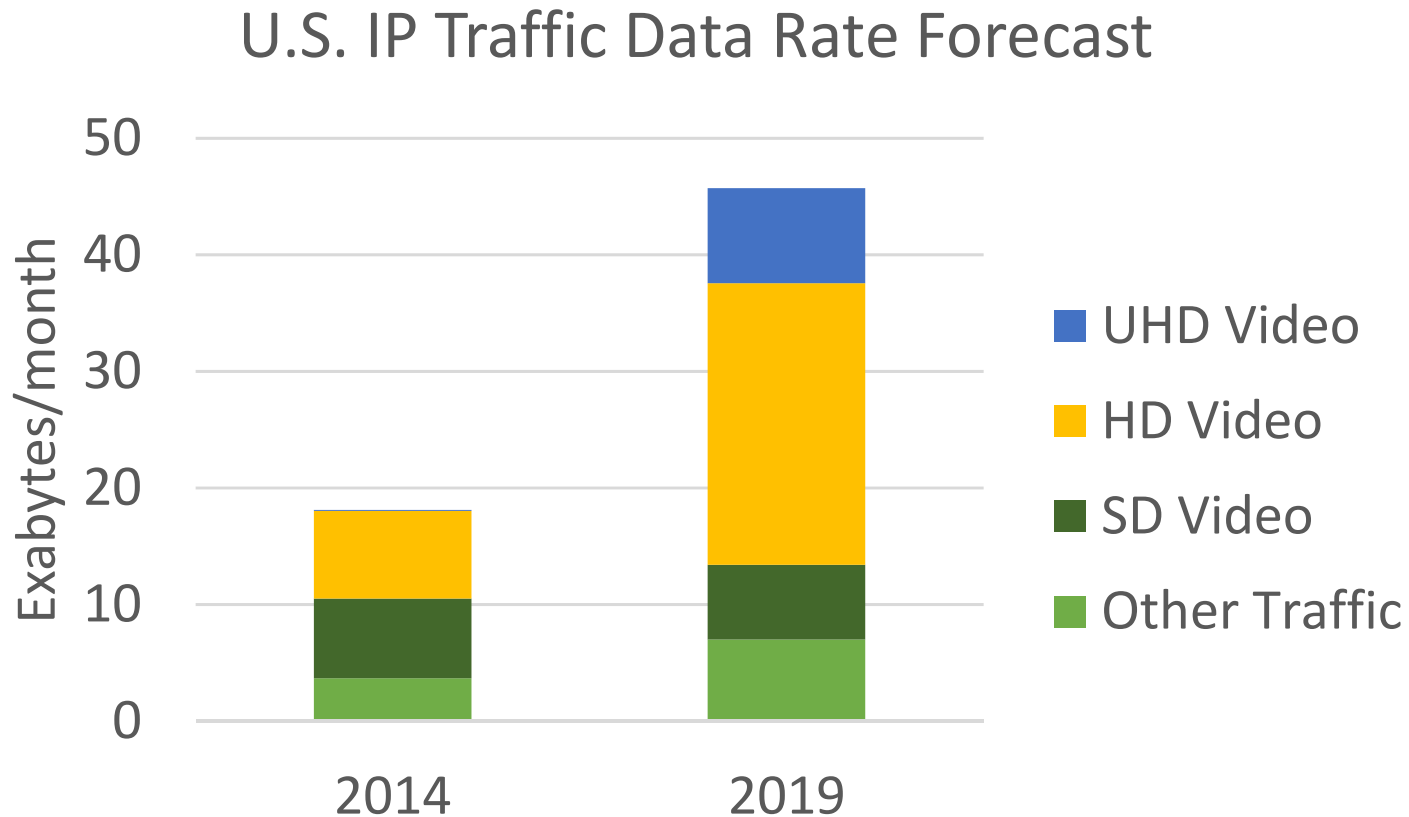# Ultra High Definition Video: System-Level Energy Impact

Gregg Hardy, Ecos Research LLC

U.S. IP traffic, driven by video, will grow 3-fold from 2014 to 2019

U.S. IP Traffic Data Rate Forecast

Legend:
- UHD Video
- HD Video
- SD Video
- Other Traffic
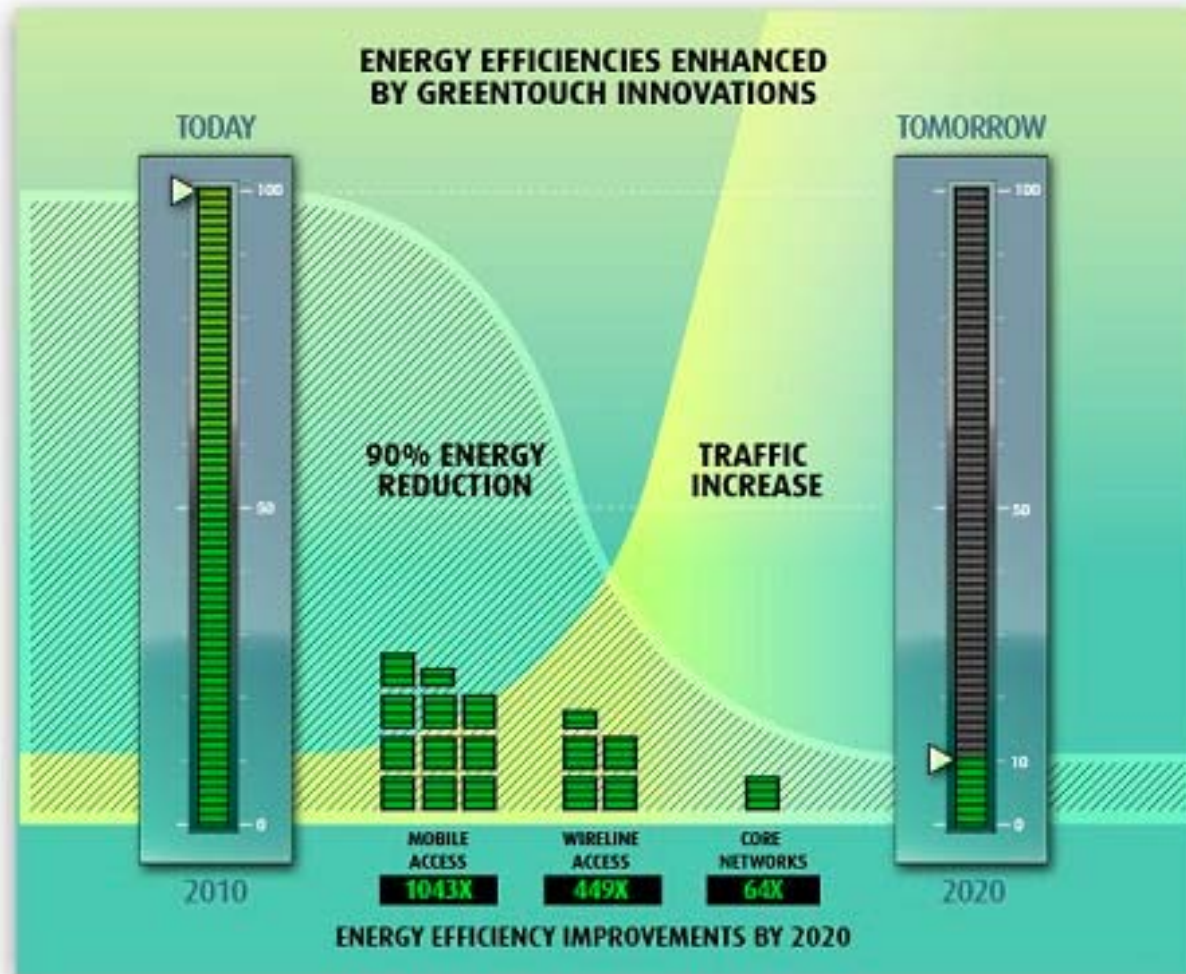
(y-axis: Exabytes/month, 0 to 50; x-axis: 2014, 2019)

IP Traffic includes consumer & business, mobile & fixed, internet video (e.g. Neflix, YouTube) & managed IP (cable, satellite & telco IP TV and VoD)

Source: Cisco VNI Forecast (May 2015)

It may be possible to reduce absolute internet energy consumption even as traffic grows

Source: Greentouch

Barriers to UHD adoption

- Competing HDR standards by Dolby, Samsung, LG, Sony & Panasonic
- Network build-out
  - *For the next few years at least, 4K streaming will be near impossible to deliver at scale, even at 10-12 Mbps, which is typically achieved by reducing the frame rate or sacrificing quality*
  - To add UHD channels, Pay-TV service providers, some of whom offer UHD STBs, will either have to:
    - Set-aside more bandwidth for TV channels
    - Reduce the total number of SD and HD TV channels
    - Stream UHD content over the internet (e.g. Xfinity)
- UHD device availability
  - While UHD TVs are gaining market share, UHD adoption in mobile devices will be slowed by reduced battery life
  - PlayStation, Xbox and AppleTV do not yet support UHD

Other trends that will increase IP traffic

▶ **Shift to online applications**

Online gaming represents the biggest potential increase in IP traffic. Total U.S. offline and online game play in 2010 represented 166 exabytes/month compared to today's total U.S. IP traffic at 14 exabytes/month.

▶ **Shift from broadcast to unicast**

AT&T has estimated that a shift from multicast or broadcast to over-the-top unicast "would multiply the IP backbone traffic by more than an order of magnitude"

Source: Cisco VNI Forecast (May 2015), GIIC "How Much Information" Study, AT&T Labs

Conclusions

▶ The shift to UHD video will contribute to the rapid growth of internet traffic

▶ Service providers will continue to build-out the internet using more efficient networking technologies

▶ UHD consumer electronics will initially use more energy, but their efficiency will improve over time

▶ Other drivers of IP network energy consumption include online gaming and unicast video

Thank You!

Gregg Hardy, Principal, Ecos Research LLC, ghardy@ecosresearch.com