

# TECHNOLOGY FUTURES INC.

A vibrant, futuristic landscape. In the foreground, a laptop on the left shows a globe on its screen. To the right, a white rocket with a blue nose cone is positioned. The background features a dark sky with glowing blue and green circuitry patterns, a red archway, and silhouettes of people. A tall lattice tower is visible on the far left. The overall scene is illuminated with a mix of blue, green, and red light.

*Your Bridge to the Future*

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# TFI 2022

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# TFI 2022 - Online

<b>THURSDAY JANUARY 20, 2022</b> (Central Time)		<b>FRIDAY, JANUARY 21, 2022</b> (Central Time)	
12:30 - 1:00	<b>Zoom opens for Networking</b>	12:30 - 1:00	<b>Zoom Opens for Networking</b>
1:00 - 2:00	<b>Broadband Keynote</b> <b>Alan Breznick</b> , Practice Leader, Light Reading Moderator, <b>Jeff Binkely</b> , Principal, Ryan	1:00 - 2:00	<b>TFI Forecasts Update</b> <b>Lawrence K. Vanston, Ph.D.</b> , President, TFI <b>Ray Hodges</b> , Senior Consultant, TFI
2:00 - 2:30	<b>Discussion Session</b>	2:00 - 3:00	<b>Wireless Keynote</b> <b>Iain Gillott</b> , President, iGR Moderator, <b>Ruben Miranda</b> , Managing Director, Kroll
2:30 - 3:30	<b>Policy Update</b> <b>CostQuest Associates</b>	3:00 - 3:30	<b>Discussion Session</b>
3:30 - 4:30	<b>Economic Update</b> <b>Michael A. Sadler, Ph.D.</b> , University of Texas at Austin	3:30 - 4:30	<b>Communications Technology Update</b> <b>August (Augie) Grant, Ph.D.</b> , Professor, University of South Carolina
4:30 - 5:00	<b>Discussion Session</b>	4:30 - 5:00	<b>Discussion Session</b>
5:00 - 5:30	<b>Virtual Reception &amp; Networking</b>	5:00 - 5:30	<b>Virtual Reception &amp; Networking</b>

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# TFI Broadband Forecasts Update

Lawrence Vanston, Ph.D.  
President,  
Technology Futures, Inc.

lvanston@tfi.com

**TFI 2022 Online**

January 20-21, 2022  
Austin, Texas

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## Technology Forecasting

- Performance Improvement
- Cost Improvement
- Adoption of New Technology
- Replacement of Old Technology
- Impacts of these changes

**Perfect for estimating lives & values  
of large capital investments**

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# Technology Forecasting Methods

- Fundamental Models of Technology Change
- Analogies
- Drivers and Constraints
- Expert Opinion



## Technology Forecasting Lessons

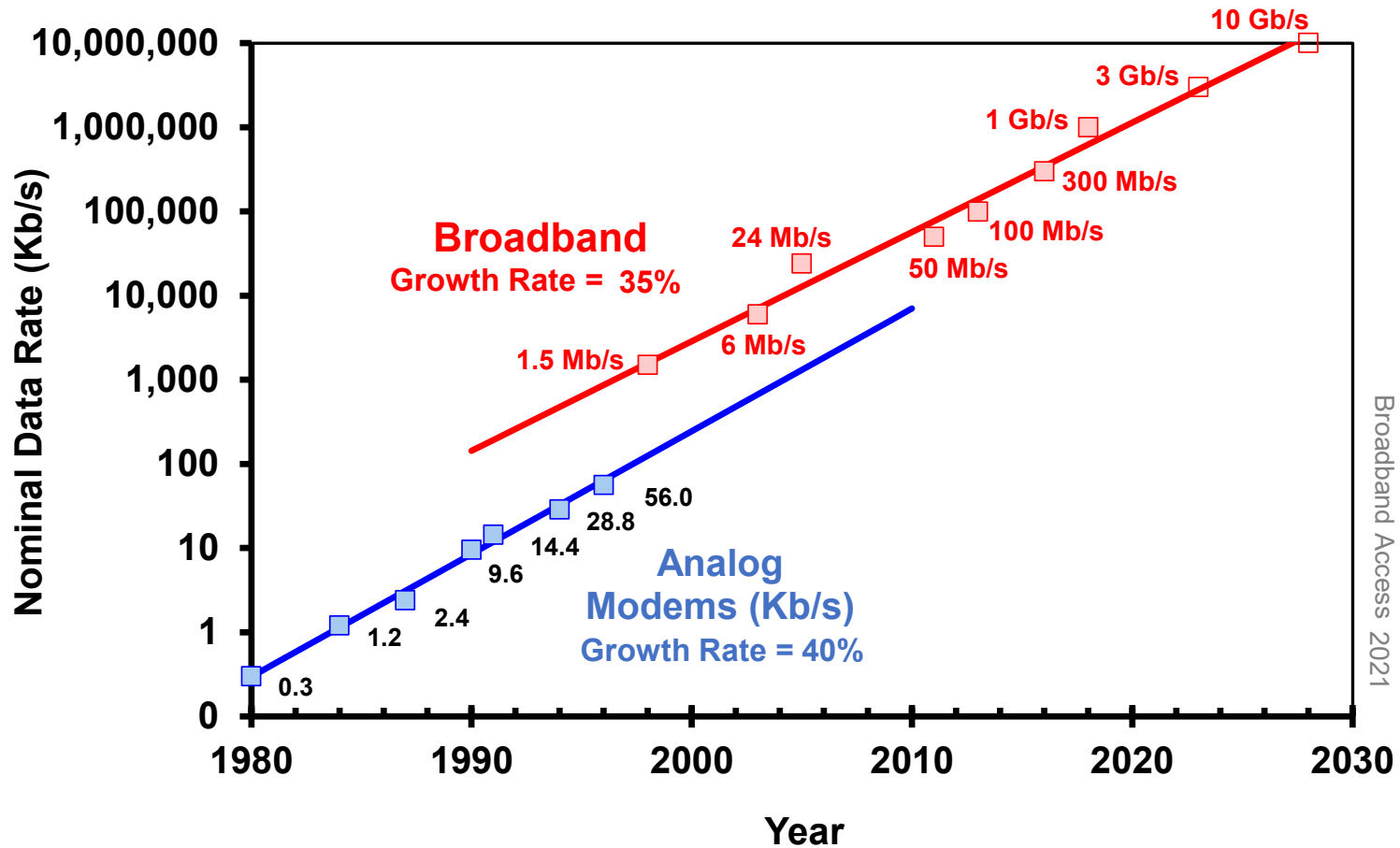
- Fundamental technology trends are relentless
- Betting against fundamental technology trends is futile
- Fundamental technology trends destroy value in old technology

# Industry Broadband Forecast

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# Broadband Performance Milestones



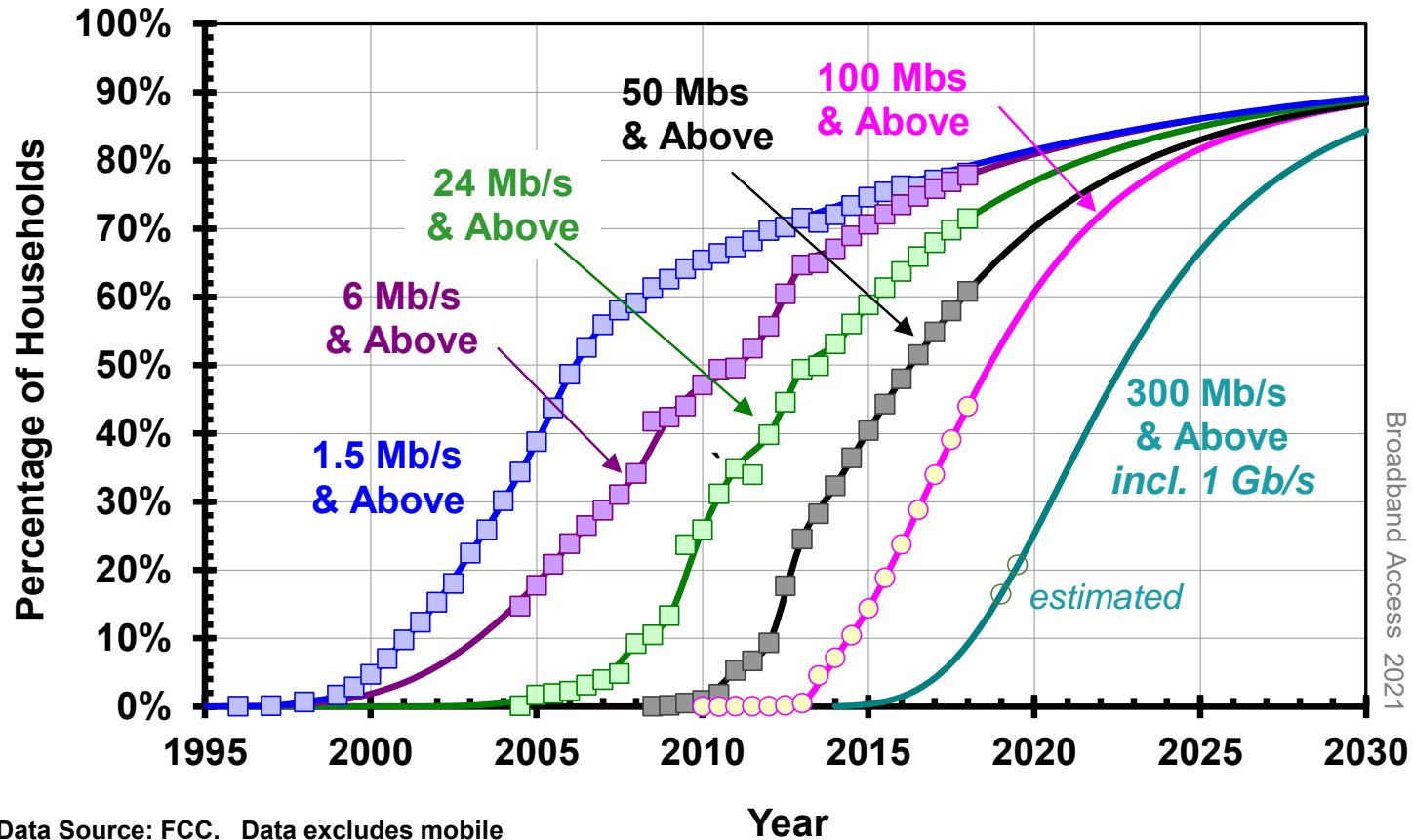
Broadband Access 2021

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Source: Technology Futures, Inc.

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# U.S. Broadband Substitutions



Data Source: FCC. Data excludes mobile wireless broadband

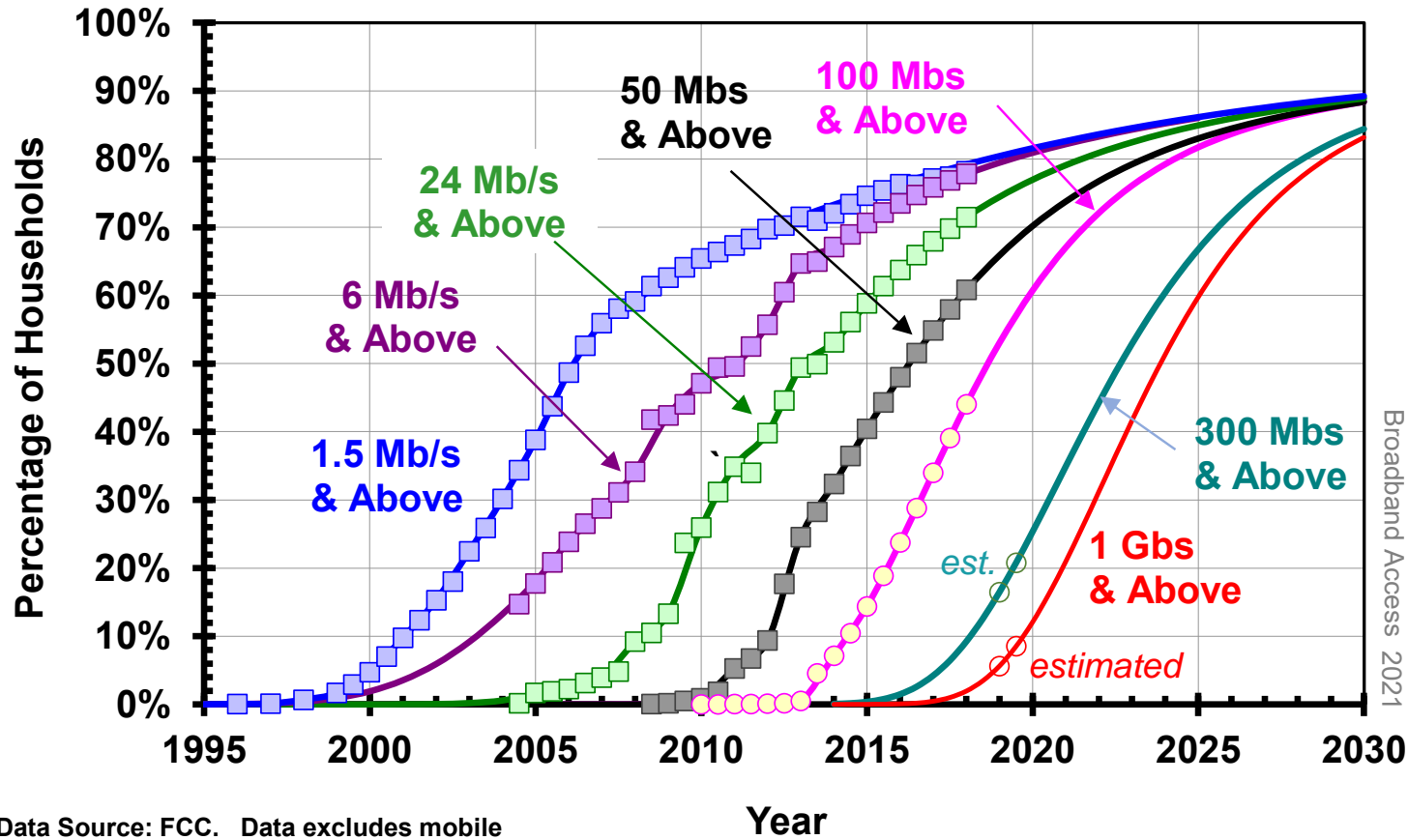
Source: Technology Futures, Inc.



<https://www.fcc.gov/internet-access-services-reports>

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# U.S. Broadband Substitutions



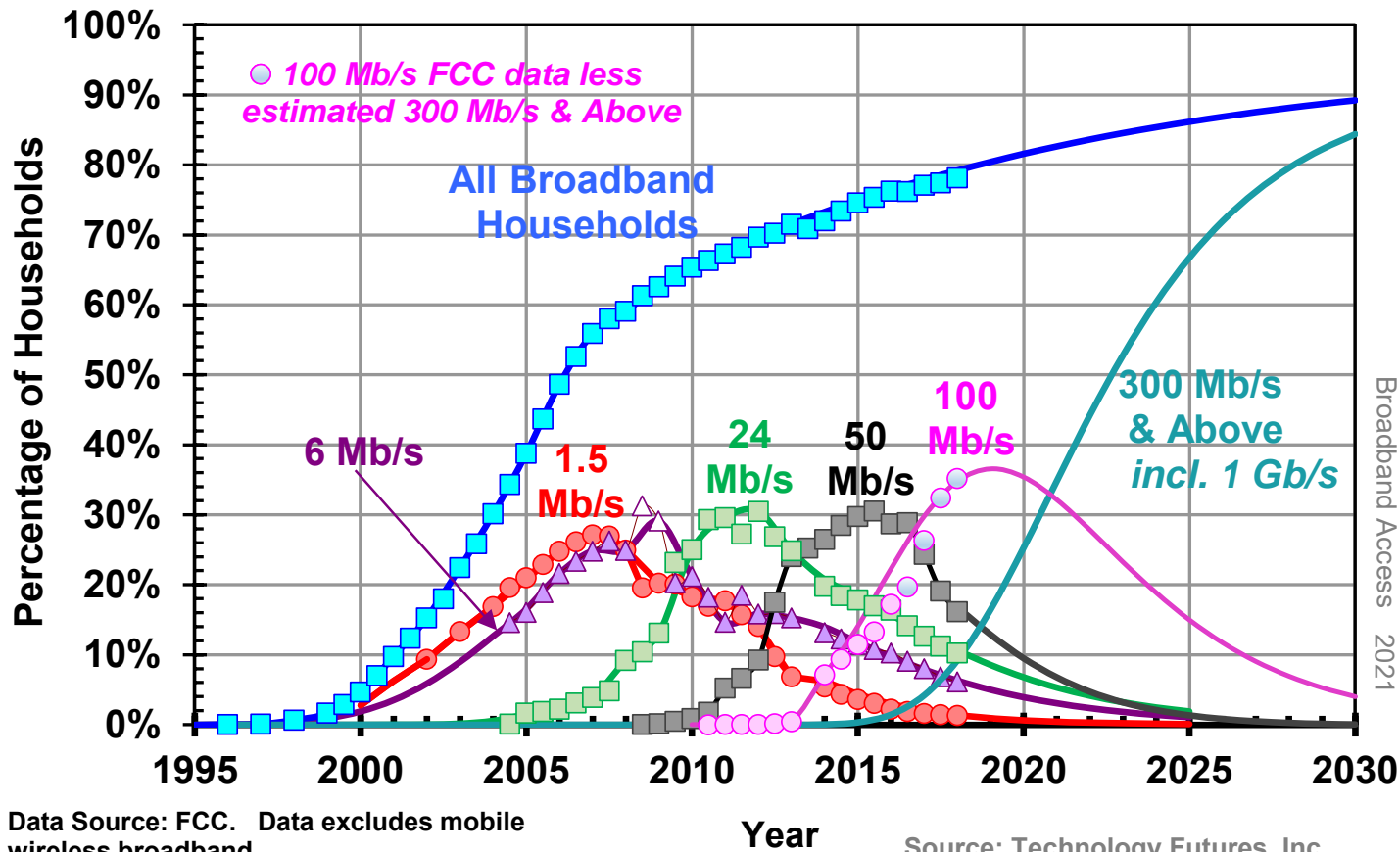
Data Source: FCC. Data excludes mobile wireless broadband

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# 2021 TFI U.S. Broadband Forecast

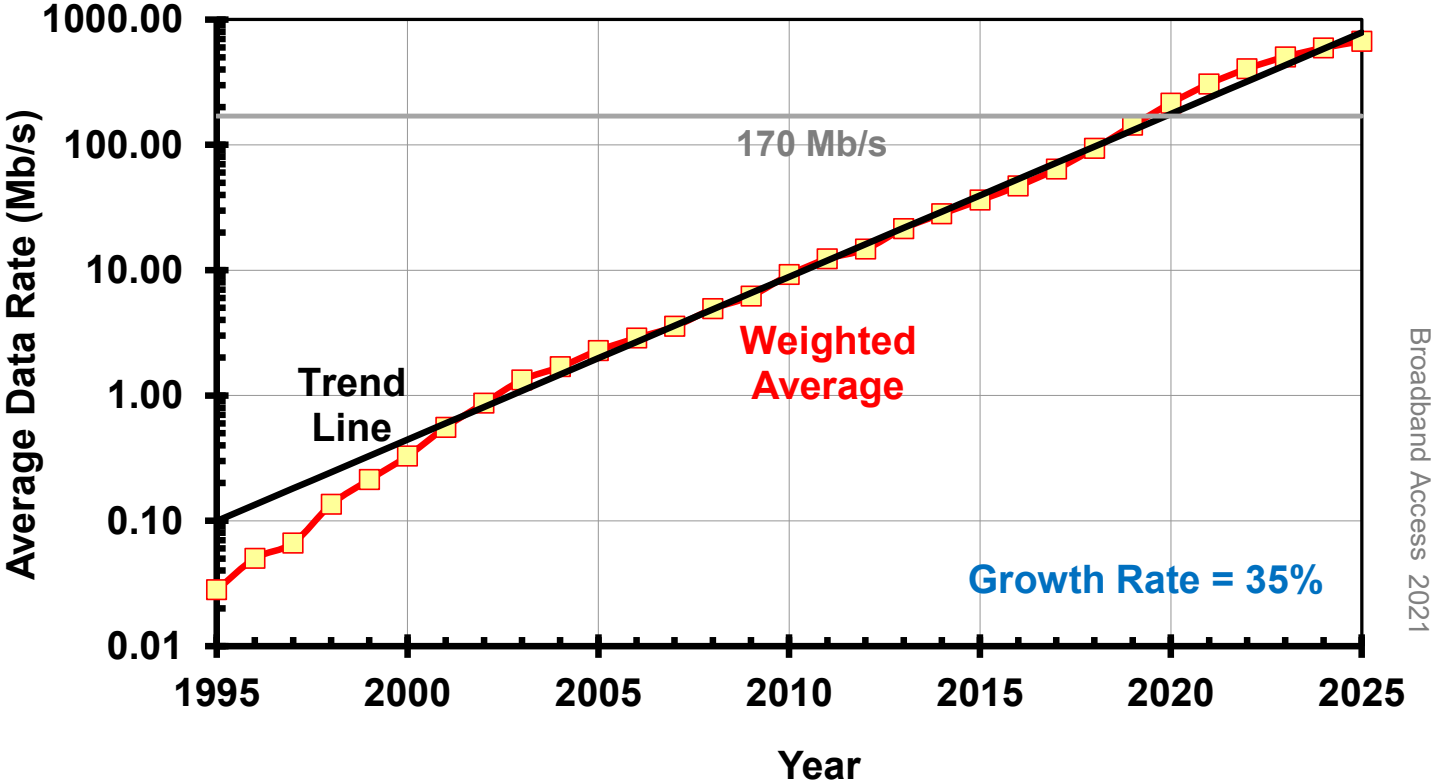


$$\text{Lifecycle (t)} = \text{Substitution (t)} - \text{Next Substitution (t)}$$

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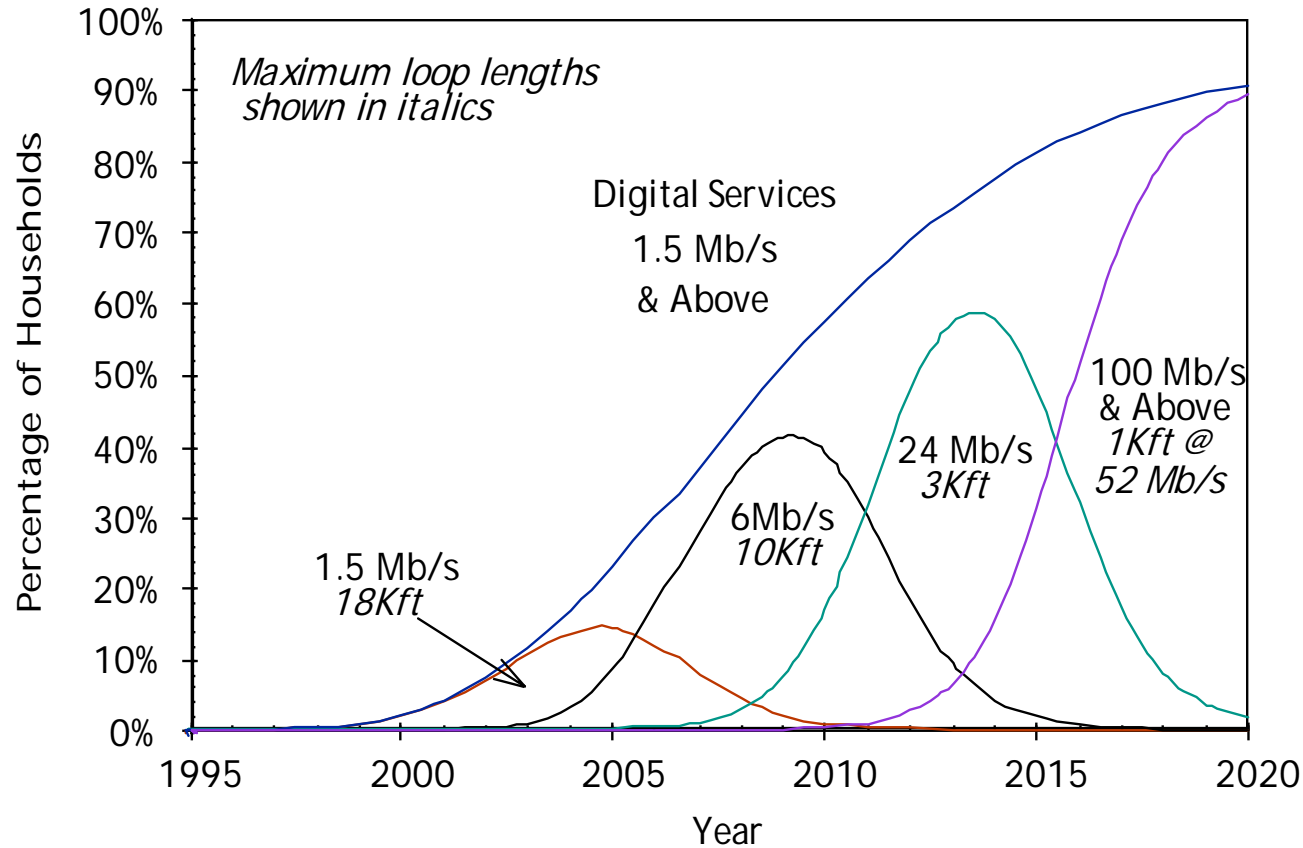
# TFI Average Broadband Speed Forecast



Source: Technology Futures, Inc.



# 1999 TFI Broadband Forecast



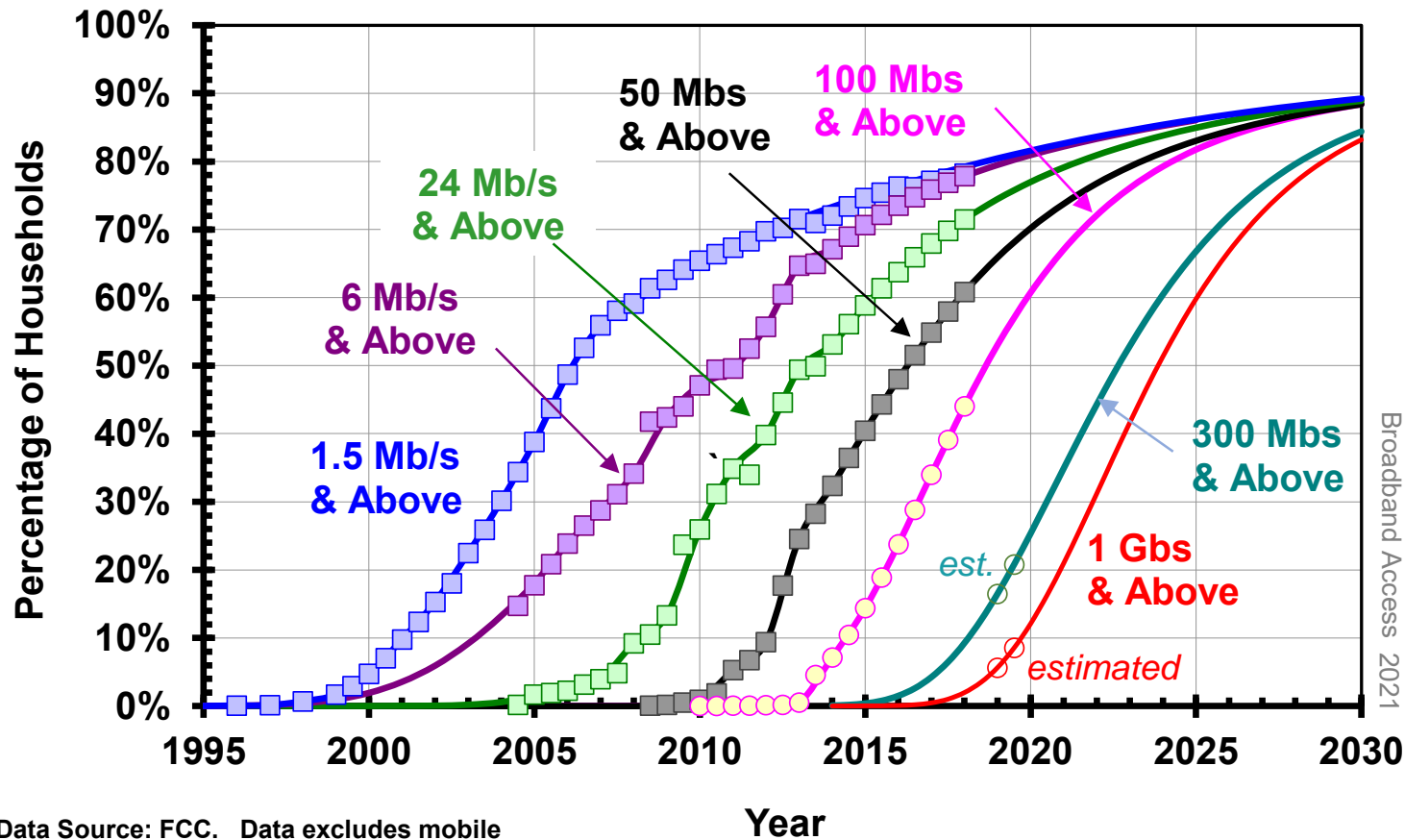
Lawrence Vanston, "Forecasts for Internet/Online Access,"  
to the 17th Annual ICFC Conference June 1999

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# U.S. Broadband Substitutions



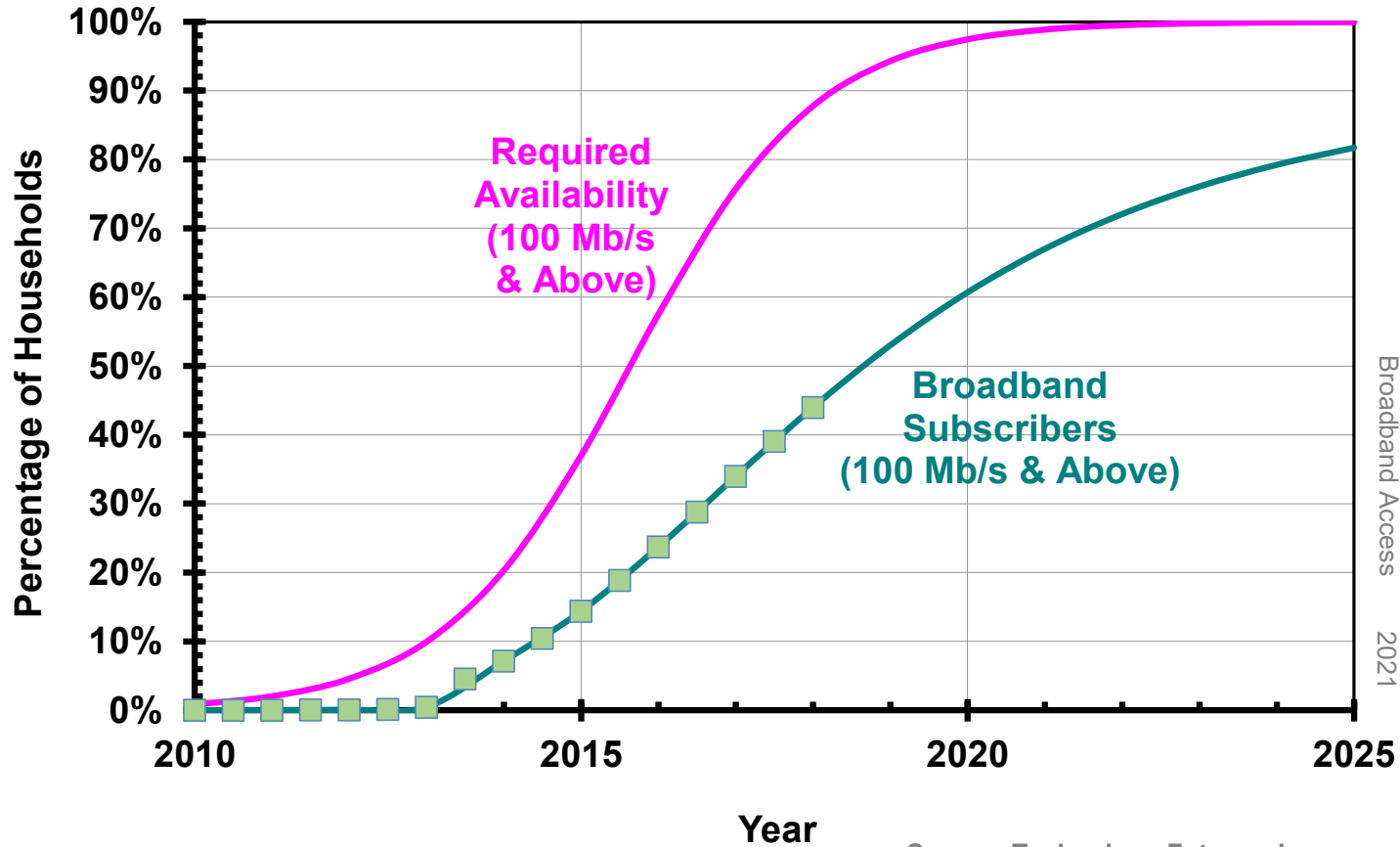
Data Source: FCC. Data excludes mobile wireless broadband

Source: Technology Futures, Inc.

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# Availability vs Subscribers, 100 Mb/s & Above

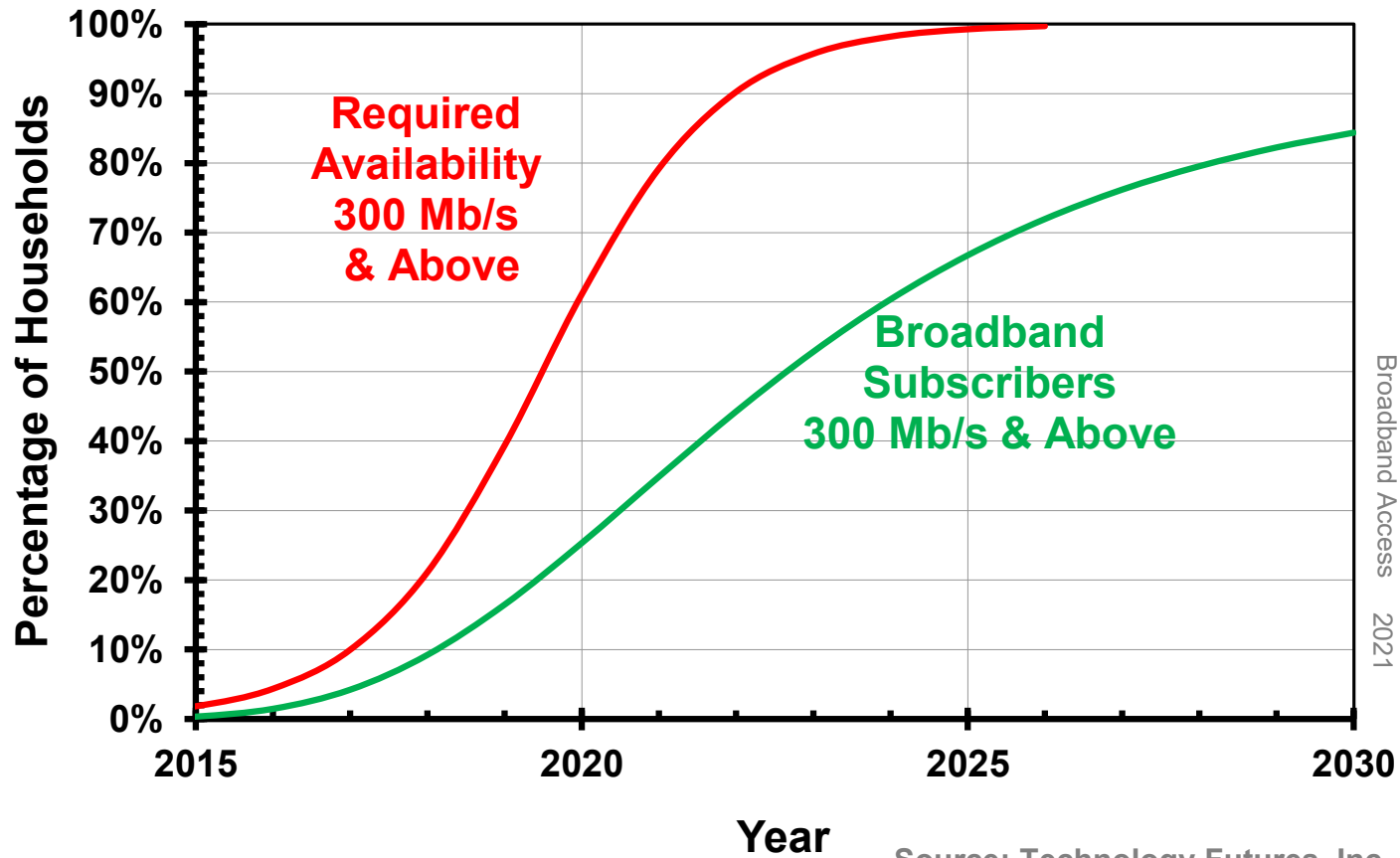


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# Availability vs Subscribers, 300 Mb/s & Above



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## Broadband Summary

- Broadband speeds continue to increase, 100 Mb/s standard. 300+ optimal. Future: 1G – 10Gb/s.
- Relentless bandwidth demand means deploying fiber and replacing equipment sooner.
- Competition from wireless, especially 5G
- Telco copper is doomed. Has been for years.

# How Long Will Broadband Speeds Increase?

## Key Technology Forecasting Principle:

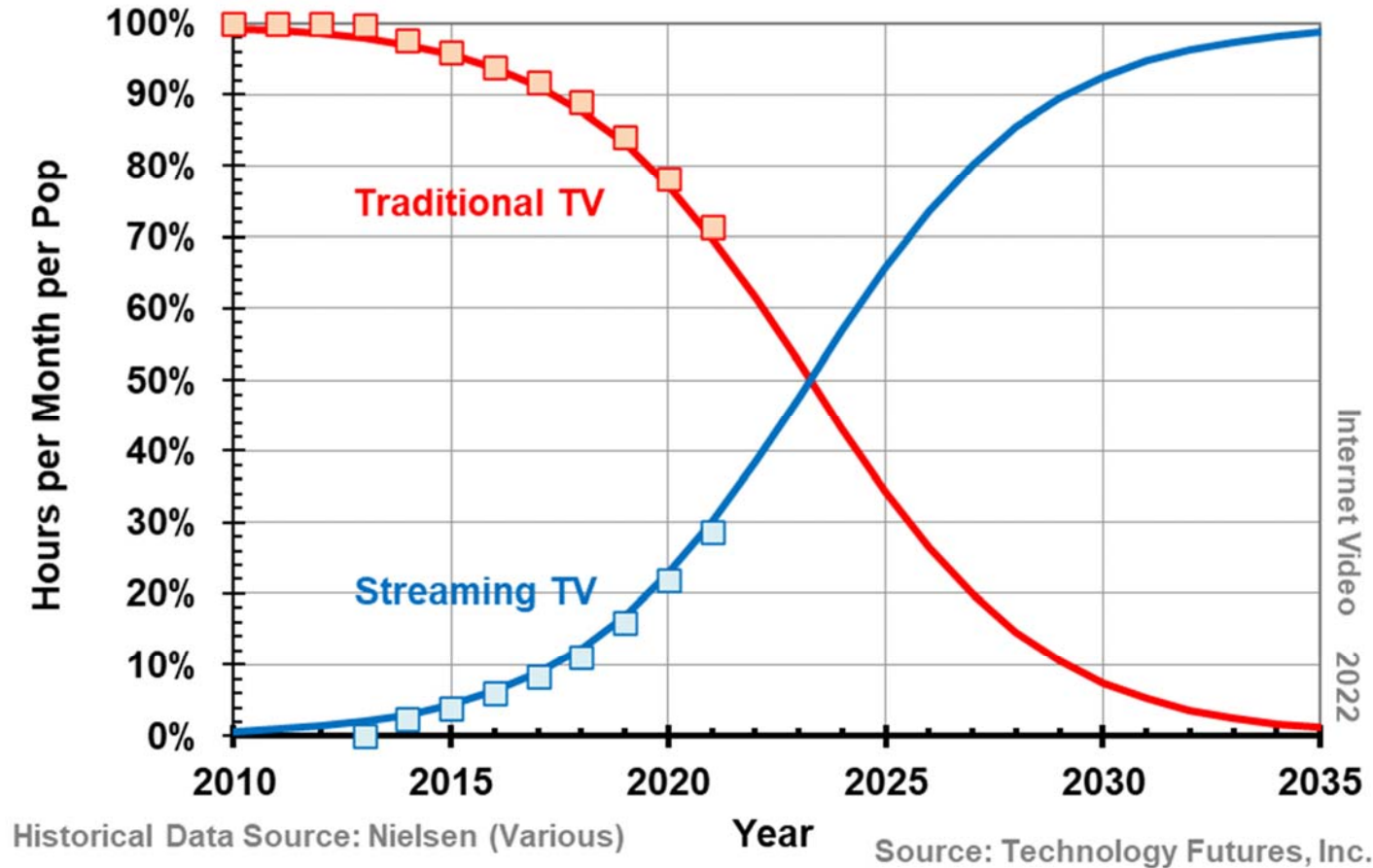
- Performance improvement will continue as long as it's:
  - Technically feasible AND
  - Useful
- The rate may change if the technology approach changes.

# Online Video Forecasts

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# Traditional TV vs Streaming TV – 2022 Forecast



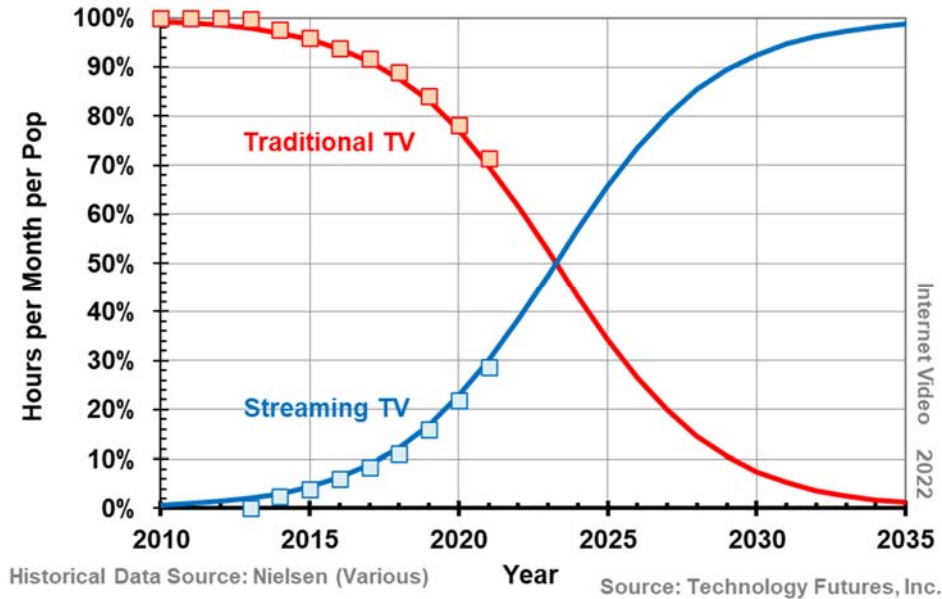
Historical Data Source: Nielsen (Various)

Source: Technology Futures, Inc.

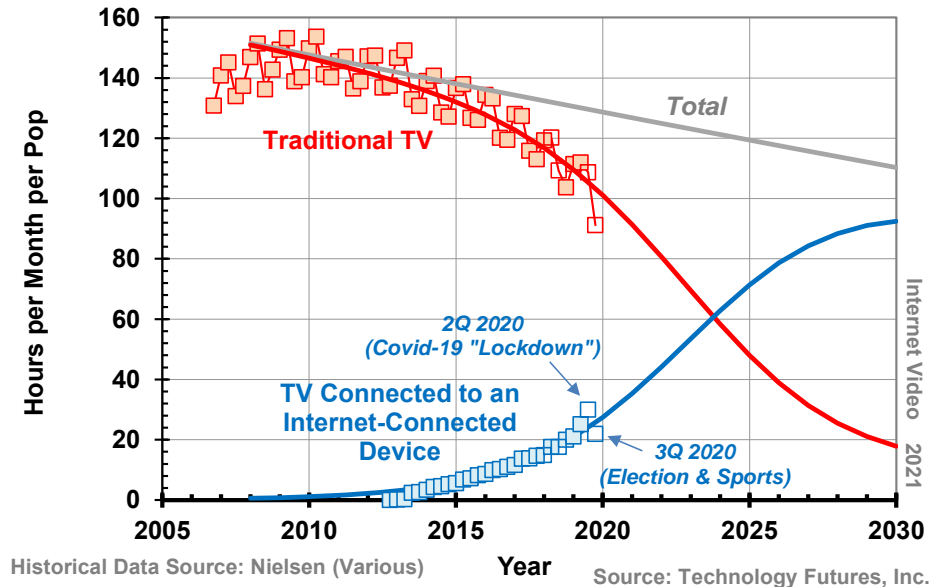
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# Traditional TV vs Streaming TV – 2022 Forecast



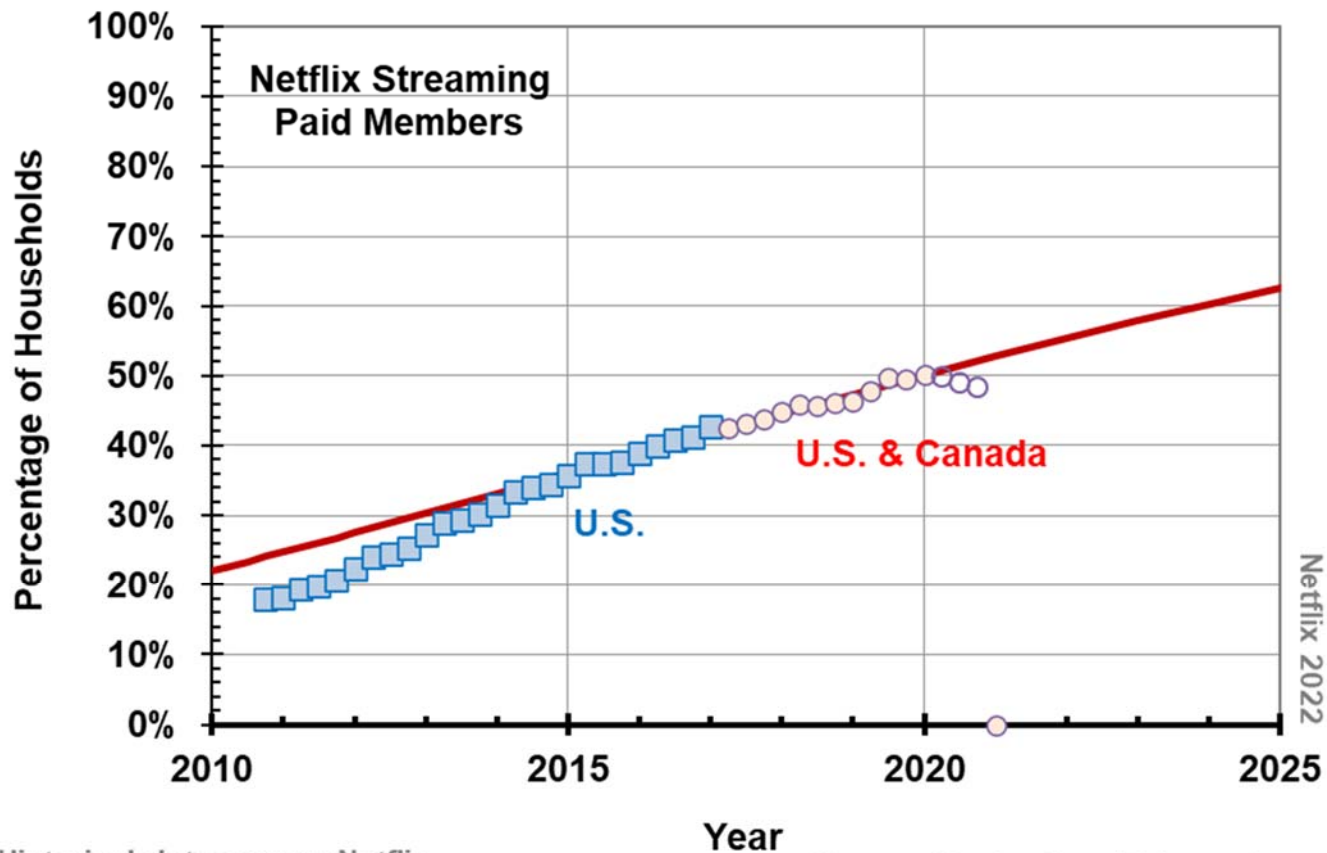
## Old Format: Traditional TV vs TV Connected to an Internet-Connected Device



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# Netflix Streaming Paid Members



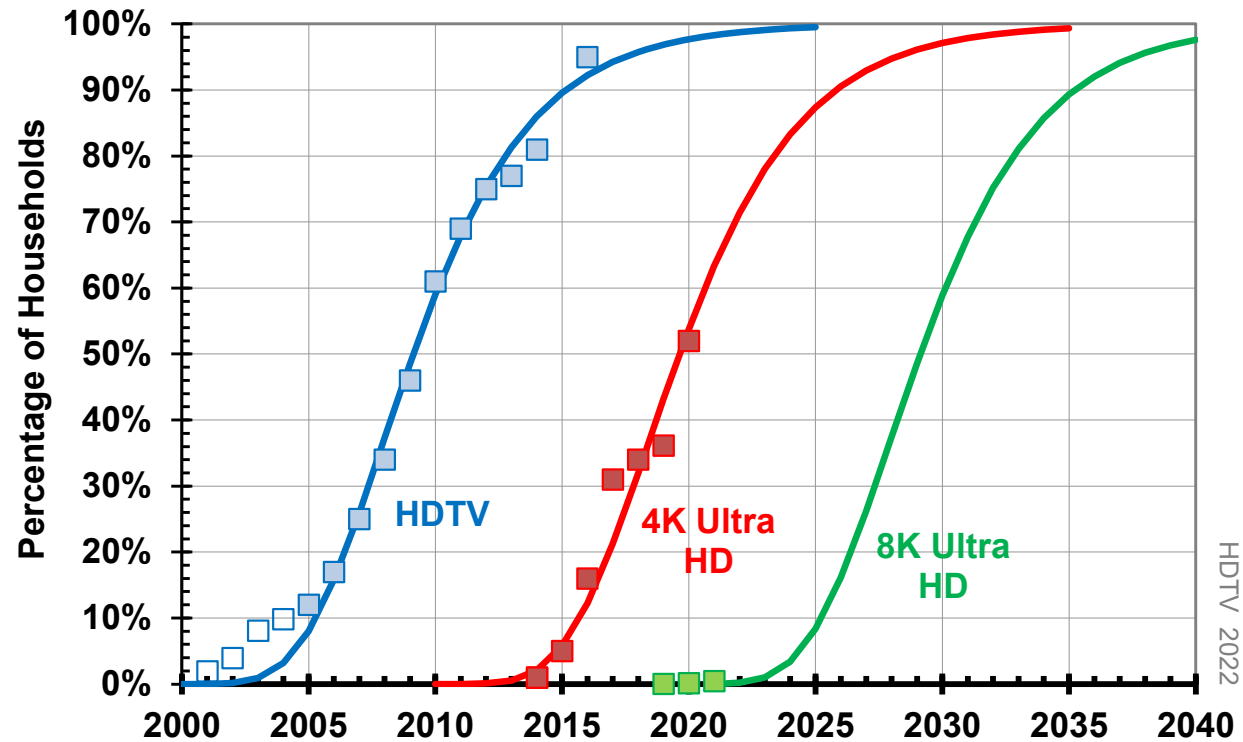
Historical data source: Netflix

Source: Technology Futures, Inc.

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# Ultra HD Households (4K and 8K)

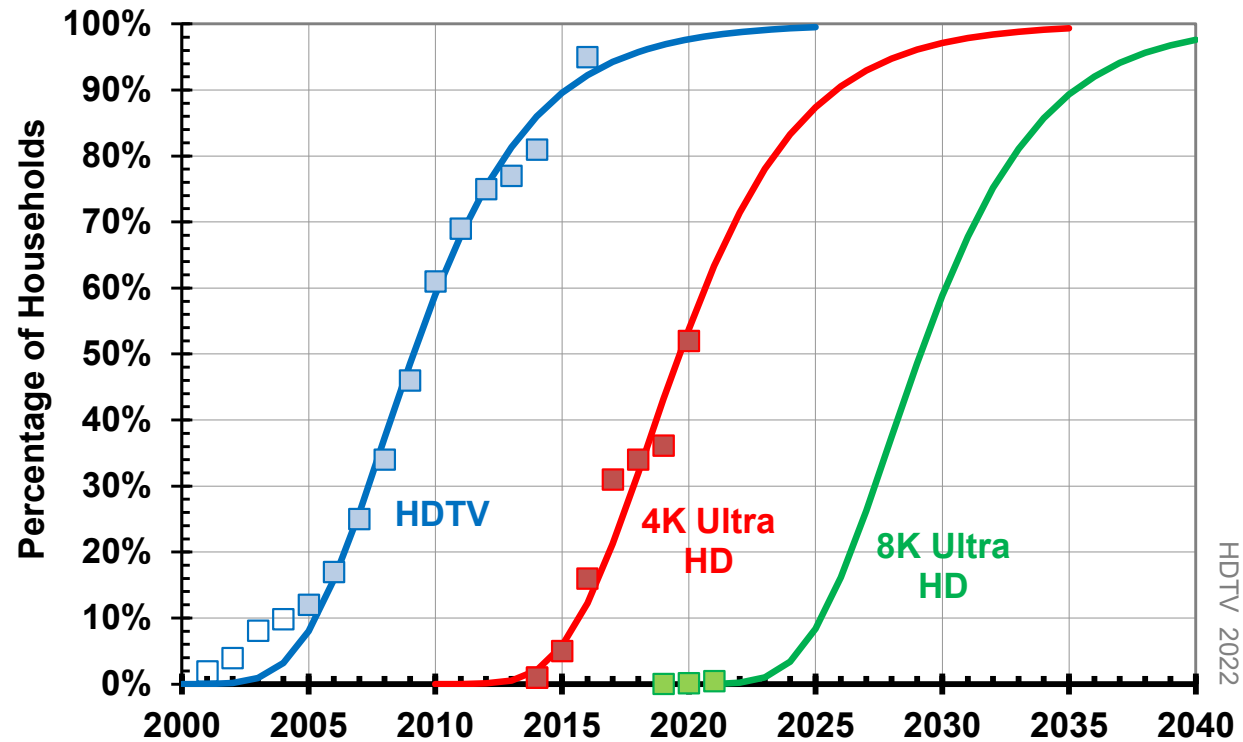


Historical data sources: HDTV - 2001-2004 Misc, 2005- Leichtman Research; 4K 2014-15 Strategy Analytics, 2016-2020 Consumer Technology Assc, ; 8K - Strategic Analytcis

Source: Technology Futures, Inc.



# Ultra HD Households (4K and 8K)



Historical data sources: HDTV - 2001-2004 Misc, 2005- Leichtman Research; 4K 2014-15 Strategy Analytics, 2016-2020 Consumer Technology Assc, ; 8K - Strategic Analytcis

Source: Technology Futures, Inc.

## Typical Streaming Data Rates

Std TV = ~ 2 Mb/s

HDTV = ~ 4 Mb/s

4K UHD = ~ 18 Mb/s

8K UHD = ~ 60 Mb/s



## Implications for Cable Companies

- Continued losses in multichannel TV subscriptions
- Continued need to provide multichannel and enhance broadband service simultaneously
- Competition from wireless, especially 5G
- Telcos have stepped up their game
- HFC networks are energy inefficient
- Increased investment in fiber, without commensurate increase in revenue
- More fiber decreases the value of existing coax



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