

Fair Cost
Recovery
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Key points

- Describe the rural broadband middle mile challenge and free rider problem
- Two-sided markets reduce financial burden on consumers
- Why Big Tech and Big Streamers have responsibility to help close digital divide

Preface

- Consensus that the status quo is not sustainable
- Many perspectives in the FCC proceeding (tax broadband, tax tech, USF unconstitutional, etc.)
- Applaud Congress and the FCC for studying USF goals and conducting the Notice of Inquiry
- Appropriate to review/update 25+ year policy
- This job requires the Administration, Congress and the FCC and the range of broadband stakeholders
- 22%, about 13 million people, lack high speed wireline internet of 25/3 Mbps or higher
- \$60 billion will help with last mile build out, but it does not cover ongoing and growing costs associated with streaming video entertainment in the middle mile.
- Video traffic comprises almost 80% of total traffic and requires increasing investment in middle mile in servers, equipment, labor, and energy (Capex and Opex). This is not covered by USF.

Why is there a shortfall in investment in rural areas?

Perspective

Geography

Demographics

Technology

Economics

Policy

The broadband industry facts

US: ¼ of world's total private broadband network investment (~\$90B/yr)

Thinly populated, only 93/mi², 36/km², US ranked #174

Limited understanding of users

Evolution from wireline to hybrid wireless networks

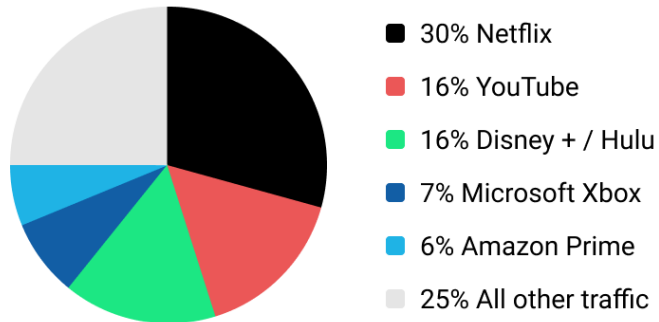
End users bear 100% of middle and last mile cost

Internet policy has not kept pace with leading use case, video streaming

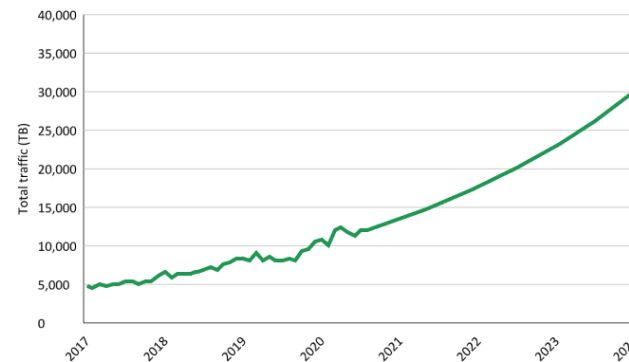
Rural broadband fiber networks

5 Streamers | 75 % of all traffic | 90 % of all cost

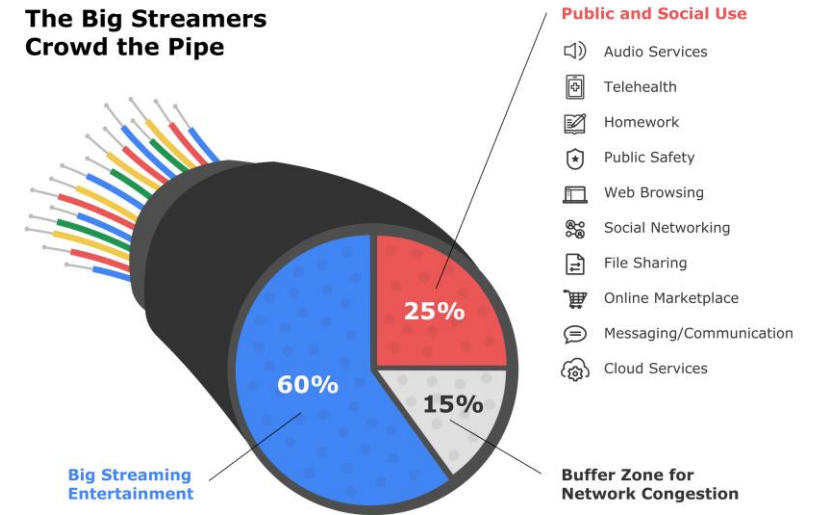
Big Streamers Traffic on Rural Broadband Providers



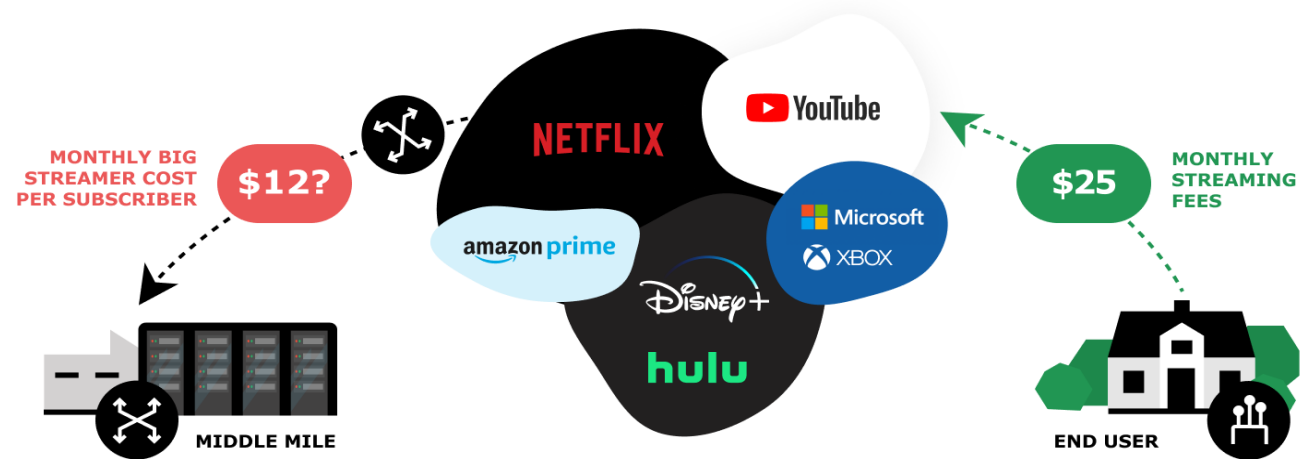
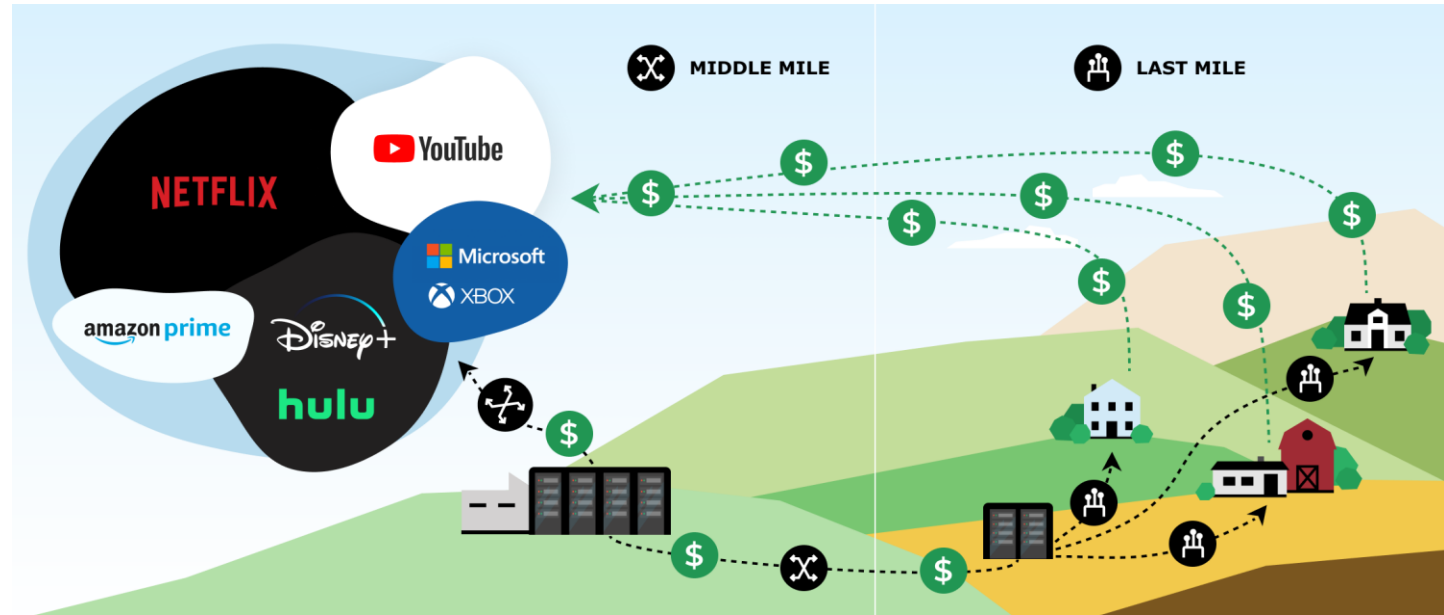
Big Streamers Traffic is growing at 30 percent annually.

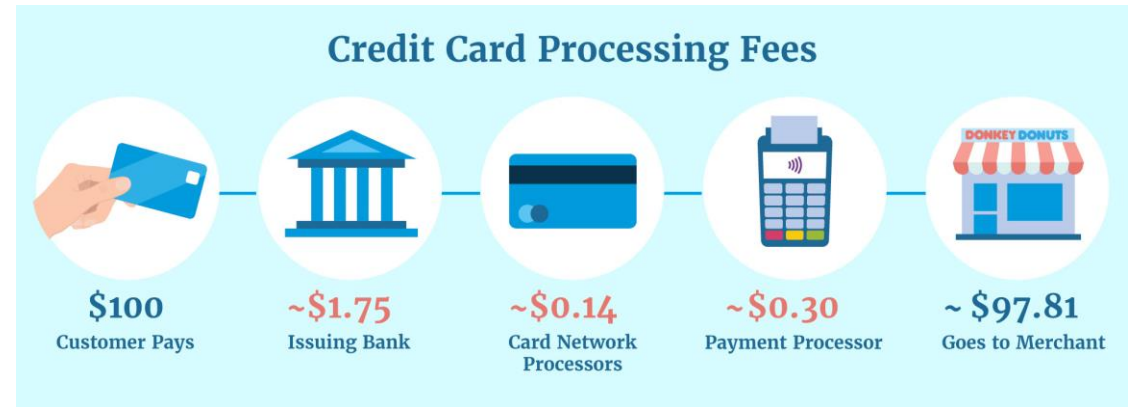
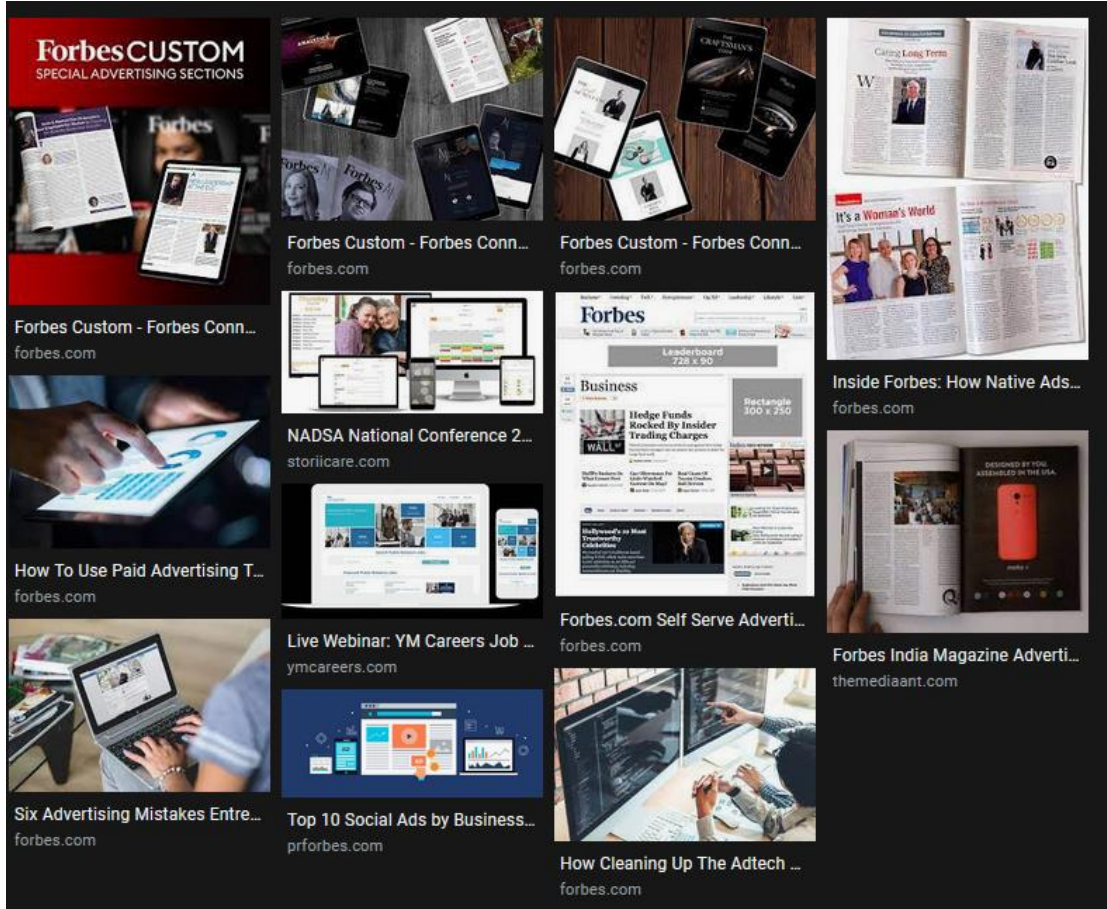


The Big Streamers Crowd the Pipe



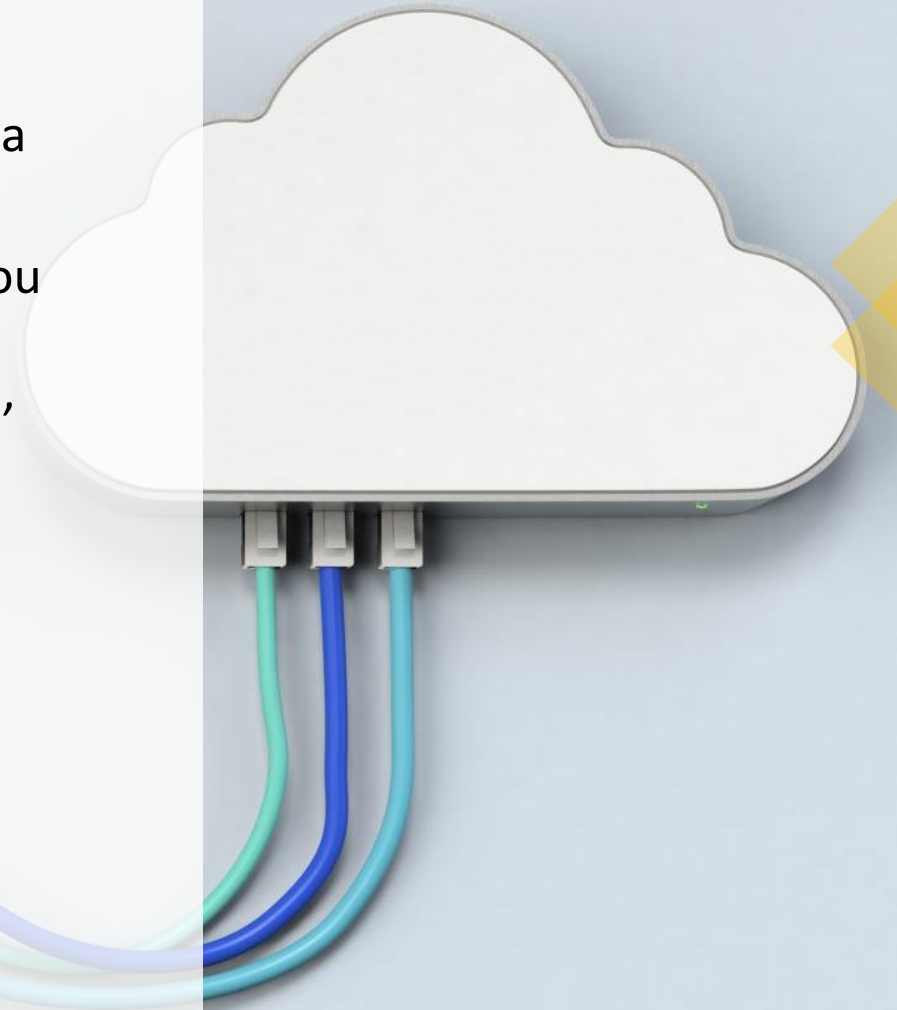
Problem: For every \$1 earned by streaming video providers, rural broadband providers incur 48¢ cost in middle mile provision *with no cost recovery*.

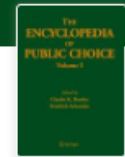




Cloud Services vs. ISP Middle Mile

- AWS, Google, and MS offer “pay as you grow” model. All data which enters the network is monetized.
- ISPs unable to engage with content providers with “pay as you go” models even though ISPs perform the same services for content: storage, database, computation, transfer, migration, networking, delivery, and security.
- Large content providers maintain expect ISPs to provide middle mile services for free.
- Consumer subscription fees cover physical last mile construction and maintenance, network technology, R&D, network management, account management, customer service; these fees are unable to keep up with increased middle mile cost caused by video streaming.
- ISPs have capital budgets that are finite and are not recoverable from rural families. Prices are flat and some revenue sources declining (CPE).





[The Encyclopedia of Public Choice](#) pp 937–940 | [Cite as](#)

Welfare Economics and the Theory of the State

[William J. Baumol](#)

Chapter

307 Accesses | 10 Citations | 10 Altmetric

Abstract

The most general attribute that distinguishes government from other organizations is its coercive role, circumscribing the activities of all of its citizens and the other inhabitants of its territories. Laws and their enforcement require members of the public to behave in certain way and preclude them from engaging in actions that some of them would otherwise undertake. Explicitly in a democracy and implicitly in any government that operates under some sort of social contract, this means that the governed must have chosen voluntarily to be subjected to coercion that prevents them from behaving as they would otherwise choose to do. Such a paradoxical arrangement nevertheless can constitute rational behavior on the part of the public. The theory of the state, in essence, entails resolution of this paradox. It will be shown that welfare economics deals with an entirely parallel issue. Indeed, the policy measures that welfare theory suggests are particular examples of coercive public sector acts that it would serve the interests of the public to support and accept voluntarily. The logic of the analysis applies to issues as varied as taxation, finance of national defense, counter-cyclical measures

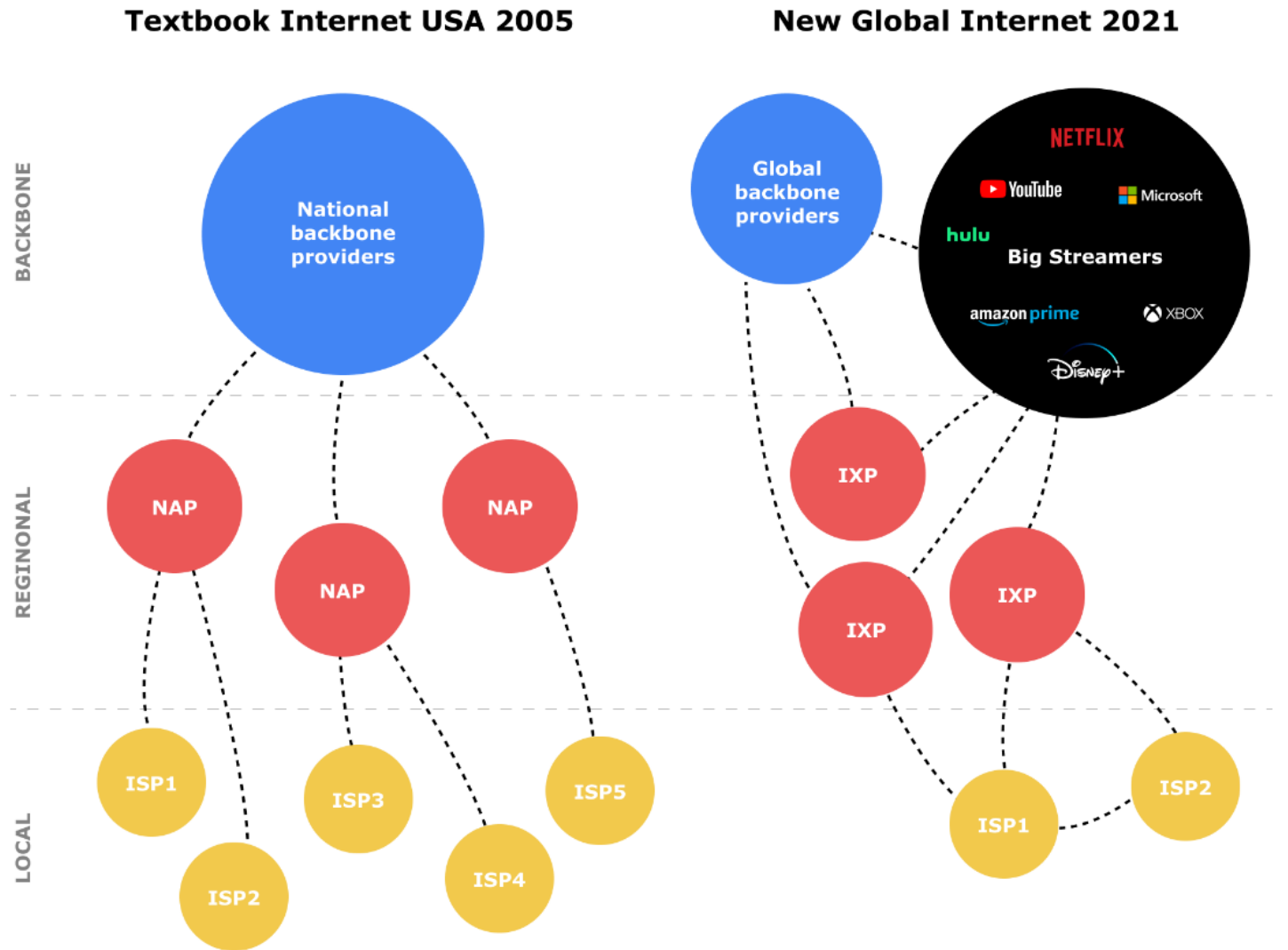
In 1952 William Baumol [described](#) the “free rider problem”, a market failure in which those who benefit from shared resources do not pay for them or underpay. Over time, this results in degraded resources or a dearth of investment, which is the current situation in rural America.

Economic Observations

- There is large cash flow in ICT ecosystem (\$30T globally with US having 1/3 of the value). Investment should not be difficult. Policy may be the problem.
- However, broadband industry is responsible for all USF and middle/last mile investment. US broadband industry ~\$300B in annual US revenue (5500 ISPs). Top 6 software/platform tech companies \$1.5T in 2021 US revenue (5x greater).
- Almost 80% of total internet traffic is streaming video entertainment from handful of providers. This is privately valuable and requires high bandwidth and investment.
- Remaining 20% of traffic is socially-valuable but does not necessarily require high bandwidth.
- Policy: Business models for broadband were developed before video emerged and the market has not evolved. Streaming companies do not participate in middle and last mile infrastructure provision, even though they disproportionately benefit.
- Rural broadband providers lack market power to engage with Big Tech/Big Streamers.

Internet Architecture

Large tech companies operate separate, unregulated internet up to point of middle mile



Adapted from Israel and Bensen, 2012. Clark 2021

INVISIBLE MILE

HIDDEN ELEMENTS THAT ARE VITAL TO ENSURING THE INTEGRITY OF THE VALUE CHAIN

Non-visible network components include the spectrum, network databases, cybersecurity etc., but can also include potential bottlenecks, like international frontiers.



FIRST MILE

WHERE THE INTERNET ENTERS A COUNTRY

International internet access, including submarine cables, landing stations, satellite dishes, cross-border microwave, etc.



MIDDLE MILE

WHERE INTERNET PASSES THROUGH THAT COUNTRY

National backbone and intercity network, including fiber backbone, microwave, Internet Exchange Points

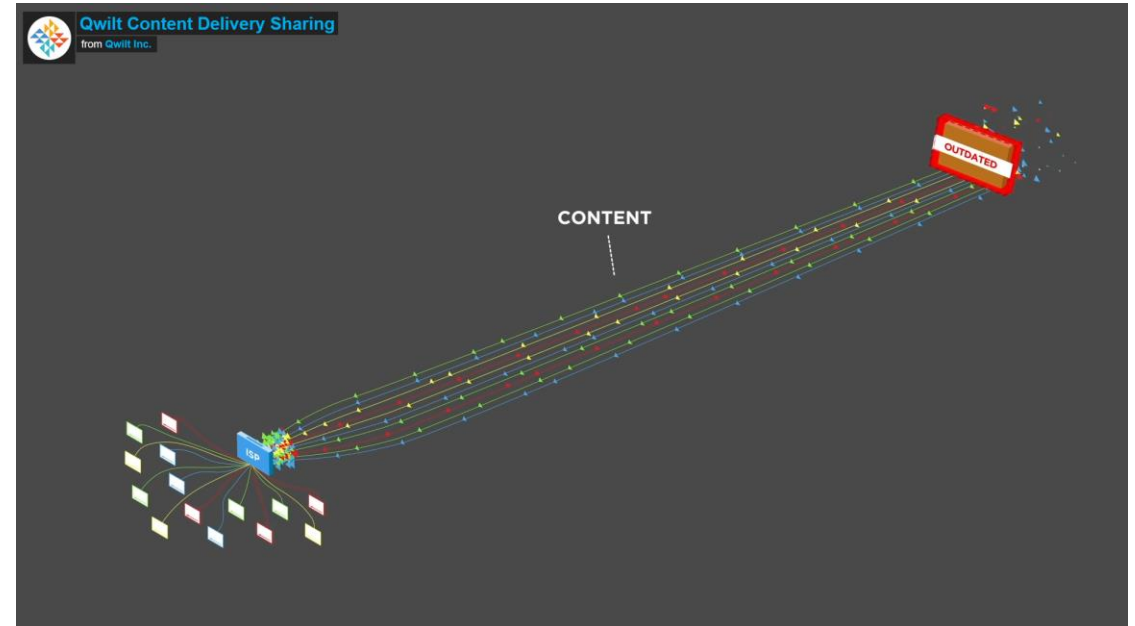
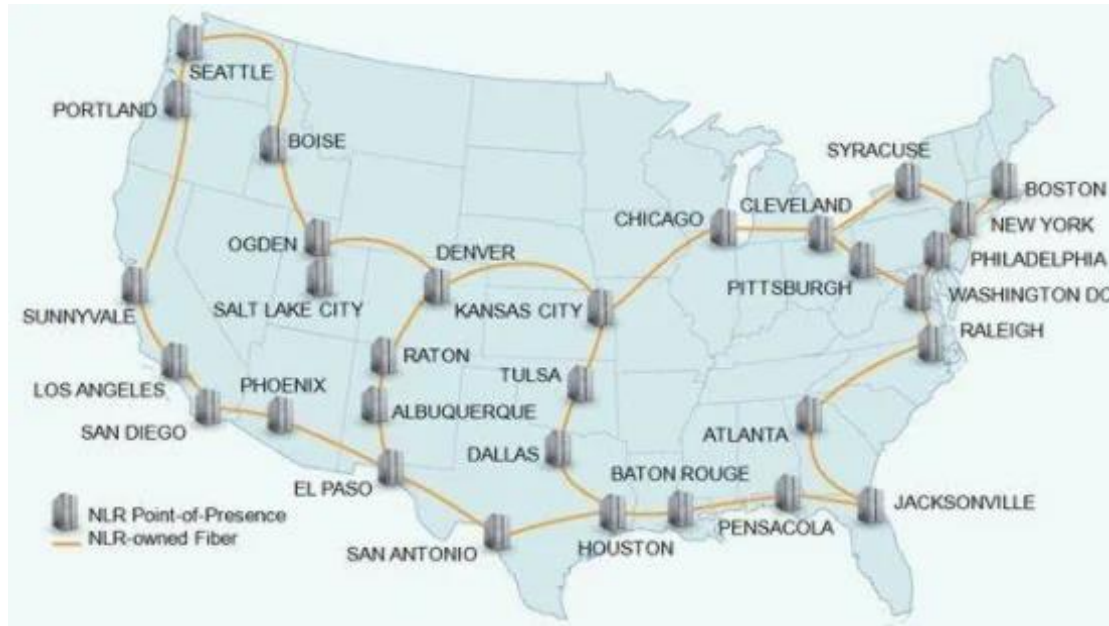


LAST MILE

WHERE INTERNET REACHES THE END-USER

Local access network, including local loop, central office exchanges, wireless masts

CDNs don't solve middle mile challenges





“Free” Netflix OCA creates new problems

- Video content has higher resolution, increased frame rate, greater dynamic range, and higher bitrate format for same content. This increases energy consumption for given movie.
- Netflix server takes space in ISP network, equipment only serves Netflix content (potentially anti-competitive).
- Increases traffic and cost within network.
- Disincentive for Netflix to compress data.
- Inhibits ISPs’ ability to develop content neutral solution.
- Inhibits ISPs’ ability to invest in climate neutral solution.

Two-sided
markets are
better for end
users

(Rural Broadband Provider w 10k subs)	Stream (2/3 households)	Don't Stream (1/3 households)	Big Streamers (5 companies)	Total Revenue to Broadband Provider	Note
Subscribers	6600	3400			
Status quo/price control	(\$17.48)		\$0	(\$115,368)	Status quo. RBP loses money from streaming. Must either forego investment or raise prices.
Raise prices on all subscribers	\$11.65	\$11.65	\$0	\$116,500	RBP earns revenue but streaming customer gets 30% discount, non-streamer pays for what she doesn't use. Could lose customers.
Raise prices on streaming users	\$17.48		\$0	\$115,368	
Two-sided markets usage fee	\$0	\$0	\$17.48 per streaming user	\$115,368	Fee charged to streaming companies.

Middle Mile Fair Cost Recovery Solutions

- Voluntary negotiation in “good faith and fair dealing” between Big Tech/Big Streamers and rural broadband providers, with government oversight to encourage a fair outcome
- Usage fee on video streaming traffic, independently verified and based on amount of data traffic. Min threshold assures that only largest providers pay (South Korea also EU, UK, India, Australia etc.)
- The government middle mile solution of \$1B for new middle mile construction will only exacerbate the operations and maintenance challenge.

South Korea's "Netflix Law"

- 23 million broadband subscribers but only 5 million watch Netflix, whose traffic increased 24x
- Amendment to Telecommunications Business Law, Presidential Decree
- Ministry of Science and ICT enforces "Telecommunications Interconnection Standard"
- Recognizes that increasing traffic requires telecom operators to increase server capacity and optimize traffic use
- Content providers with 1 million users or 1% of network traffic for last 3 months must pay reasonable usage fee to telecom operator
- Facebook, Disney+ already paying but Netflix refuses



Minister, Ministry of Science and ICT

Lim Hyesook

EDUCATION

- Ph.D. in Electrical Engineering and Computer Science, The University of Texas at Austin
- Master's in Control and Instrumentation Engineering, Seoul National University
- Bachelor's in Control and Instrumentation Engineering, Seoul National University
- Songgok Girls' High School

CAREER

- 2021 Co-Chair of The National Mid- to Long-term Agenda Committee
- 2021 Chairperson of National Research Council of Science & Technology
- 2020 President of The Institute of Electronics and Information Engineers
- 2019 Regular Member, The National Academy of Engineering of Korea (present)
- 2018 Dean, The Department of Electronic and Electrical Engineering at Ewha's ELTEC College of Engineering
- 2013 Senior Member, Institute of Electrical and Electronics Engineers (present)
- 2005 Lifetime Member, The Association of Korean Woman Scientists and Engineers (present)
- 2000 Engineer, Cisco Systems
- 1996 Researcher, Bell Lab.
- 1986 Researcher, Hewlett Packard

Why Big Tech/Big Streamers Should Contribute?

- Those who benefit for networks should pay for them. Payment should scale with size and benefit.
- Greater revenue = greater social obligations. Big Tech has minimum of 3x greater profitability compared to the entire ISP sector.
- Focus on handful of tech companies is sufficient to fulfill policy goal; declining returns to scale with long tail of tech companies. Limit participation only to largest, most successful companies and establish a financial incentive to make video streaming delivery more efficient. Policy and incentives for video compression could reduce traffic.
- Streaming video entertainment traffic is the problem, not Zoom calls, ecommerce, or online banking. Fair cost recovery should reflect the actual source and amount of cost.
- Traffic assessment should be estimated, transparent, independently verifiable and updated.
- Encourage market solutions as much as possible to avoid growing regulatory programs. Freedom/flexibility for rural broadband providers to participate
- Congress should define the Big Tech and Big Streamers that benefit from the network and have the social obligation to help pay for broadband networks in the least populated areas of the country. The definition could be based on revenues, number of active users or market capitalization thresholds.