



# ***Net Neutrality and Innovation at the Edges***

***Mark A. Jamison***

***Director***

***Public Utility Research Center***

***University of Florida***



# Context

- Blockage or degradation of VoIP
  - Madison River Communications, LLC; Telmex; Belize, Brazil, UAE
- Content and app restrictions
  - AT&T (iPhone) denies Google Voice; South Korea cable ISPs block video; AT&T (iPhone) refused full version of Slingplayer app
- Comcast throttles Bit Torrent
- Part of net neutrality issue (Wu, 2004; Hahn and Wallsten, 2006)



# Net Neutrality Proponents

- Innovation should only occur at the edges of the network; the network itself is simply infrastructure that should not add value. Wu (2003, 2004)
- Violating net neutrality
  - decreases incentive for network capacity. Cheng et al. (2007)
  - Makes everyone worse off. Economides (2007)



# Light-handed viewpoint

- Offering premium transmission will improve customer choice and ISPs would not degrade anyone's service. (Whitacre, 2006)
- Too soon to regulate



# Policy Questions

- Should content providers be allowed to obtain value-improving services from networks?
- Should all content providers be allowed to use infrastructure for free?
- Should some customers have protected QOS if it means limiting QOS of others?



# Research Questions

- Does the provision of premium network service increase or decrease innovation at the edges, or have no effect?
- Does the provision of premium network service increase or decrease consumer welfare, or have no effect?



# Analytical Model

- Three stages in decision process
  - network provider chooses network services and capacity
  - content providers choose investment in content and which network services to purchase
  - consumers buy network service and use content



# Content Site Value

- Site value to consumer depends upon
  - Content value, which results from
    - Provider innate ability to provide valuable content
    - Provider investment
  - Delivery speed
    - Customers value their time
    - Sometimes information is time sensitive



# How Speed Affects Value

- Some information is time sensitive (value degrades)
  - eBay, day trading
  - Hermalin and Katz (2007)
- Value does not degrade during transmission (non-degradation) for other types of information
  - SSRN, Amazon, Google, Euro CPR, etc.



# How speed is obtained

- Locate servers across net
- Efficiency in site design
- Caching (Akamai)
  
- Could some content providers benefit from an additional option?



# Premium Service

- Each consumer visit to site triggers transmission
- Assume times between consecutive requests are iid with mean  $1/h$  where  $h$  is the arrival rate of requests (hits) (Mendelson, 1985)
- Assume queuing system for hits with a Poisson arrival process



## Premium Service (2)

- Little's Law: Average number of jobs in a stable system is equal to their arrival rate times their average time in the system
  - Average wait time  $W=1/(\mu-h)$  when no premium service
    - $\mu$  is the capacity of the network
  - Average speed is the inverse of the average wait time for consumers



## Premium Service (3)

- Do not specify technology for differentiating service
  - General M/M/1 model
  - Premium service gives purchasers priority when network becomes congested



# Premium Service Tariff

- Does the tariff give content providers an “information” rent?
  - Do customers select tariff option or can tariff be individualized?
    - Absent regulation, tariff would be individualized
- Tariff price based on profitability of content site



# For content that does not degrade

- Content providers with innately lower abilities value premium service more than those with innately higher abilities
  - Adds an option for differentiating content sites
  - More obscure search engines more likely than Google to purchase premium services
    - Returns on speed higher relative to returns on content
  - May help explain why some leading content providers advocate net neutrality
  - Not sure why marginal content providers advocate net neutrality



# Innovation at the Edges

- *The variety of content at the edges of the network increases when the network provider optimally chooses to offer premium transmission services. Furthermore, the value that consumers receive from the sites that purchase the premium transmission service is greater than the value they would receive if the premium service were not offered.*
  - Premium service promotes innovation at the edges



# Why Google wants net neutrality

- *When premium transmission service is offered and at least one content site purchases the service, profits for content sites that do not purchase the premium service are lower than if the premium service had not been offered, all other things being equal.*



# Consumer Subscription

- *More consumers subscribe to the network service when premium transmission service is offered and at least one content site purchases the service than if the network provider did not offer the premium service.*



# Related Issues

- Content site neutrality?
- Should networks be treated differently from content sites?
- Can the same rules work equally well across all network technologies?



# Non-neutral content sites

- Google censors search results by country
- Amazon highlights and simplifies buying from Amazon
- Google Voice won't connect calls in rural areas



# Technology issues

- Should networks and software be treated differently?
  - Unclear that there is a logical reason for different treatment
- Are all networks alike?
  - No. Wireless needs different management approach than wireline because marginal costs are different



# Summary of Analytical Conclusions

- When networks offer premium network services, low-value content sites are more likely to purchase the services than are higher value sites
- Therefore, the premium services stimulate innovation at the edges